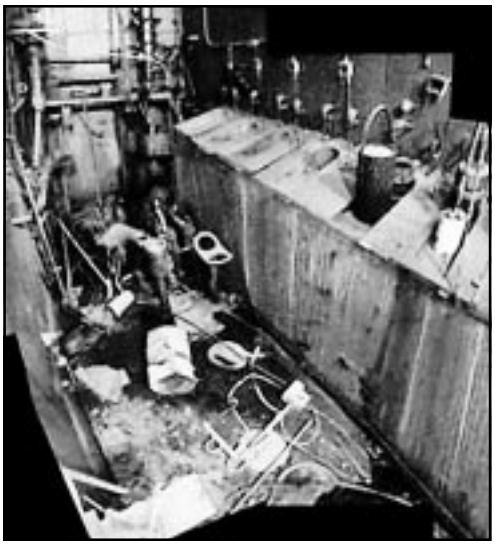
Deactivation and Decommissioning Focus Area

QUARTERLY REPORT

July — September 2001 Activities



Office of Science & Technology

NETL

D&D Focus Area

On the Cover

Clockwise from Upper Left:

New projects for FY2002 include: the West Valley Demonstration Project Hot Cell D&D LSDDP, the INEEL Fuel Pools and Material Dispositioning LSDDP, the Mound Facilities Long Term Stewardship Initiative, and the LANL Tritium Technology Deployment LSDDP.

The purpose of this document is to provide an overview of the Deactivation and Decommissioning D&D Focus Area and to update readers on the program's current activities. It presents a synopsis of the current program status and recent accomplishments, along with overviews of planned activities, program issues, and opportunities. Quarterly reports are distributed to U.S. Department of Energy DOE headquarters and operations office managers, site personnel, site operating contractors, technology developers, principal investigators, regulators, and other stakeholders. Issued in January, April, July, and October, the D&D quarterly reports summarize the activities of each preceding quarter. Quarterly reports and further information about the D&D Focus Area DDFA are found on the World Wide Web at *www.netl.doe.gov/dd*. Technologies are usually identified by their discrete tracking numbers within the Technology Management System (TMS) operated by DOE's Office of Science and Technology (OST). Providing access to information about OST programs, technologies, and linkages to EM problems, TMS is found on the World Wide Web at *ost.em.doe.gov/tms/home/entry.asp*.

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1.0 HIGHLIGHTS

Oxy-Gasoline Cutting Torch and Personal Ice Cooling Suit to be Deployed in Argentina.

As part of the activities of the Joint Coordinating Committee for Radioactive and Mixed Waste Management (JCCRM) between DOE and the National Atomic Energy Commission in Argentina (CNEA), the DDFA has arranged to provide two oxy-gasoline cutting torches, two personal ice cooling suits (PICS), and associated training to workers in Argentina. The oxy-gasoline cutting torch and the PICS were both demonstrated in the Fernald Plant 1 Large Scale Demonstration and Deployment Project (LSDDP), and both have become widely deployed within DOE and nuclear utility decommissioning projects in the United States. CNEA plans to deploy both technologies for decommissioning a heavy water plant, for maintaining operating nuclear power plants, and for use in courses at universities in Argentina. This is the first time that the DDFA and CNEA have deployed decommissioning technologies in the field. Additional decommissioning technologies are expected to be shared by the U.S. and Argentina.

DDFA Program Highlighted at American Nuclear Society's Executive Conference on Nuclear Facility Decommissioning and Used Fuel Management.

As part of the American Nuclear Society's Executive Conference on Nuclear Facility Decommissioning and Used Fuel Management, the DDFA chaired a session on state-of-the-art decontamination and decommissioning (D&D) technologies and presented an overview of the DDFA Program. Other presentations involving the DDFA included the D&D technology safety evaluation program with the International Union of Operating Engineers (IUOE), the deployment of D&D technologies through the Accelerated Site Technology Deployment (ASTD) Program, and the size reduction of the Tokomak Fusion Test Reactor at Princeton using the diamond wire saw. The conference was held July 8–11, 2001, in Mashantucket, CT.

Chicago Pile 5 Research Reactor LSDDP Receives Energy 100 Award.

The Chicago Pile 5 (CP-5) Research Reactor LSDDP received an Energy 100 Award. The CP-5 LSDDP served as the pilot project for demonstration of improved decontamination and decommissioning (D&D) technologies in DOE's decommissioning projects. Twenty-two improved D&D technologies were demonstrated during decommissioning of the CP-5 Research Reactor and 12 of those technologies have been subsequently deployed in decommissioning projects throughout the DOE complex. The CP-5 LSDDP and the eight LSDDPs that followed are sponsored and managed by the DDFA. The Energy 100 Award acknowledges the tremendous success of the DDFA's LSDDP program and specifically honors the CP-5 LSDDP as one of DOE's top 100 scientific and technological accomplishments during the past century.

West Valley Hot Cell LSDDP

▼LSDDP Selection Statement.

The West Valley Hot Cell LSDDP was the latest project selected to be part of the DDFA LSDDP group of projects. The letter has been prepared to forward to the Ohio Operations Office on the selection of the West Valley Hot Cell LSDDP.

▼Fog and Strip Technology Reduces Cost and Improves Worker Health and Safety.

A fog and strip technology was demonstrated in the NETL-sponsored LSDDP with Los Alamos National Laboratory (LANL) on disposition of plutonium-contaminated metallic objects such as gloveboxes. The fog and strip technology consists of applying a fog spray to fix airborne radioactive contamination onto surfaces followed by application of a strippable coating to remove the contamination. The team on the LANL LSDDP decided to conduct the demonstration in a plutonium-contaminated PermaCon structure at Nuclear Fuel Services in Erwin, TN. The demonstration resulted in a 1,000-fold reduction in airborne contamination within the PermaCon structure. The reduction in airborne contamination allowed workers to enter the PermaCon structure with less costly protective clothing reducing the cost for protective clothing from $3,000 per day to $200 per day. Application of the fog and strip technology in the DOE's decommissioning projects with airborne contamination promises to reduce cost through use of less costly personal protective equipment and improve the health and safety of workers.

▼Ultra-Lift Motorized Handcart Demonstrates Great Safety Benefit in INEEL LSDDP.

In the NETL-sponsored LSDDP with the INEEL, an Ultra-Lift Motorized Handcart was demonstrated to transport heavy objects up or down stairways. The Ultra-Lift Motorized Handcart uses a battery-operated screw drive to vertically lift objects and to walk the objects over the steps. The Ultra-Lift Motorized Handcart is able to raise 1,500-pound objects a height of 36 inches. In the July 2001 demonstration, a 110-pound robot was transported up and down a narrow stairway with tight corners and small landing. The workers readily endorsed the motorized handcart as an alternative to manual lifting, forklift, or hand truck. Advantages include: fewer workers needed to move heavy objects on stairways; reduction in risk of back and other injuries; and elimination of damage to equipment. Based on these safety improvements, INEEL plans to routinely use the Ultra - Lift when transporting heavy objects in stairways. It is expected that other DOE sites will also begin to purchase and use the Ultra-Lift Motorized Handcart.

▼DDFA Assists in Cleanup After Terrorist Attack.

The DDFA has contacted its technology vendors with equipment that could be useful in cleaning up the damage at the World Trade Center and the Pentagon. Many of our technology vendors are already assisting in the cleanup effort or are interested in participating. Equipment and services include protective clothing, heavy demolition equipment, vacuum systems, liquid solidification agents, waste containers, and cutting equipment. In addition, several DOE environmental remediation sites have sent equipment to the two locations.

RaceScan Communication System Accelerates Schedule of Cleanup Activities.

A RaceScan Communications System was demonstrated in the NETL's-sponsored LSDDP with LANL. The RaceScan Communications System was used to communicate among workers that are excavating fiberglass-reinforced crates containing plutonium-contaminated gloveboxes and among workers that are installing vents in waste drums. In the former case, the improved communication accelerated the excavation work by 16 percent, while in the latter case, the RaceScan Communications System accelerated the drum vent installation work by 50 percent. The amount of schedule acceleration depended on the degree of communication required by the task and the installation of drum vents required careful and continuous communications by the work crews. The full-face respirators worn by the workers and equipment noise make communication difficult and workers use hand signals for communication or leave the area for detailed discussions. RaceScan is an in-ear communications system used by the automobile racing industry for drivers and pit crews to communicate with each other. Based on results of the demonstration, many other DOE sites have contacted the DDFA for information on purchase of the units.

Basic Science Grants Awarded.

Thirteen new basic science grants have been awarded by the EM Science Program in the area of D&D. These three-year projects will be initiated in FY2002. On November 27 and 28 the EMSP and DDFA will host a kick-off workshop in Knoxville, Tennessee. This meeting will provide an opportunity for principal investigators to meet and interact with DOE end users as well as to tour an actual weapons production facility at Oak Ridge National Laboratory. For more information and to register for this workshop, visit the EMSP homepage at *http://emsp.em.doe.gov/.*

2.0 Project Summary Table

The following table summarizes the Technical Task Plans for the D&D Focus Area Core Program and related Crosscutting and Industry Program contracts. Project descriptions follow in subsections 2.1 through 2.5 and are organized by the work breakdown structure (WBS) element listed here.

Project Number	D&D WBS Element	Project Name	Page
AL08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Los Alamos National Laboratory Transuranic Waste	8
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ID08DD21	Demonstrations and Industry Approaches	Large-Scale Demonstration: Idaho National Engineering and Environmental Laboratory Fuel Storage Canals and Underwater and Underground Facilities	12
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SR09DD61	Demonstrations and Industry Approaches	Highly Selective Nuclide Removal System—Accelerated Site Technology Deployment	15
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NV09DD61	Demonstrations and Industry Approaches	Oversize Transuranic Waste Laser Cutting System, Nevada Test Site—Accelerated Site Technology Deployment	18
CH30DD11	Demonstrations and Industry Approaches	Smart 3-D Characterization of the Brookhaven Graphite Research Reactor (BGRR)	18
RF09D21 RF08SD10 RF09DD61	Demonstrations and Industry Approaches	Rocky Flats Environmental Technology Site—Accelerated Site Technology Deployment and the D&D Initiative	20
OH30DD11	Demonstrations and Industry Approaches	Diamond Wire Saw Demolition and Size Reduction of a Reactor Bioshield—Accelerated Site Technology Deployment	22
OH10DD21	Demonstrations and Industry Approaches	Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel and Tanks Utilizing a Universal Demolition Processor—Accelerated Site Technology Deployment	22

2.1 Demonstration and Industry Approaches

Los Alamos National Laboratory (LANL) Transuranic (TRU) Waste Characterization, Decontamination, and Disposition Large Scale Demonstration and Deployment Project (LSDDP)

Objective and Scope: The LANL TRU Waste Characterization, Decontamination, and Disposition LSDDP addresses the characterization, decontamination, and volume reduction of oversized metallic TRU waste currently in storage at TA-54, LANL's storage and disposal area. The LANL TRU LSDDP reflects the cooperative interest of industry, government, and academia to bring collaborative expertise and strength to the Department of Energy's (DOE) TRU decontamination and decommissioning (D&D) program at LANL and elsewhere within the DOE complex. LANL currently has 1,500 cubic meters of TRU waste in inventory, stores 313 plutonium-contaminated gloveboxes in a 24,000-square-foot facility, and expects to generate another 2,500 cubic meters from ongoing operations in coming years.

The major objectives of this LSDDP are to

- Identify technologies that are ready for deployment for the characterization, decontamination, and volume reduction of TRU waste/TRU contaminated metallic objects.
- Identify technologies that are ready for demonstration.
- Demonstrate those technologies with potential to reduce cost, risk, and schedule and that are amenable for direct field application at LANL and elsewhere in the DOE complex.
- To the extent possible, compare technologies side-by-side with baseline approaches to evaluate their advantages (cost, risk, and schedule) and to refine or validate baseline assumptions.
- Capitalize on the combined corporate management and technical strength of private industry, government, and academia.
- Demonstrate a leveraged funding pool of federal and private monies via cost sharing to address issues of national importance.
- Provide ready access to demonstration results through an aggressive communication program.

Status and Accomplishments: The following demonstrations have been completed: AeroGo Air Lift Pallet System

Mega-Tech Blade Plunging Cutter

(Tech ID 2396), Vehicle and Cargo Inspection System (VACIS)(Tech ID 2912), Mega-Tech Blade Plunging Cutter (Tech ID 2953), NT Vision System (Tech ID 3069), Mobile Characterization System (Tech ID 2959), RaceScan (Tech ID 3129), and Fog and Strip (Tech ID 3143).

Current Reporting Period Activities: The Fog and Strip demonstration was completed at the plutonium-contaminated PermaCon structure at Nuclear Fuel Ser-

Vehicle and Cargo Inspection System (VACIS)

vices. The Derived Air Concentration was reduced from 500 to 0.5. As a result, the cost of personal protective equipment worn by workers is reduced from $3,000/day to $200/day. The strippable coating attained 99 percent removal of contamination (DF=100).

A design review was held in Los Alamos to coordinate the Florida International University—Hemispheric Center for Environmental

Technologies (FIU-HCET) design of an automated crate opening system. The design review identified a change of direction for the program that would provide LANL with a product that meets a more immediate need. The crate opening demonstration was conducted at Florida International University (FIU). Five cutting tools were evaluated for opening the LANL fiberglass reinforced plywood crates.

For more information:

http://www-emtd.lanl.gov/LSDDP/DDtech.html

Tech ID 2203

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Mound Tritium D&D LSDDP

Objective and Scope: The Mound Plant in Miamisburg, Ohio, began operations in 1948. The site's mission, originally to fabricate the neutron initiator for the atomic bomb, expanded to include research, development, and production of numerous nuclear and non-nuclear weapons components, production of radioisotopically fueled thermoelectric generators, and surveillance of nuclear weapons components.

The objective of the Mound Tritium Deactivation and Decommissioning (D&D) LSDDP is to identify, demonstrate, and evaluate innovative technologies applicable to D&D of tritium facilities. D&D of Mound's surplus tritium facilities, the T and R/SW Buildings, provides a unique opportunity to compare, evaluate, and eventually execute innovative D&D technologies alongside baseline technologies in an ongoing project. The Mound LSDDP will identify and explore methods to improve worker safety while achieving cost and schedule savings. The project is expected to identify technologies that, when implemented in the Mound LSDDP, will produce significant savings compared to the $57.8 million baseline. The results and successes of this demonstration project will benefit similar DOE facilities and projects.

The Mound Plant, Miamisburg, Ohio commenced operation in 1948.

The T Building is an underground reinforced-concrete structure built in 1948 for the purification of polonium-210 used in nuclear weapons initiators. Later the facility was used to extract other radionuclides, house the plutonium verification facility, and store TRU materials. Facilities large enough to handle multi-kilogram quantities of tritium were added to the building. Current plans are to decontaminate T Building to allow potentially unrestricted public reuse by the year 2003. The SW Complex and one corridor of rooms in the adjacent R Building form the SW/R Complex. Four types of operations have been performed in these facilities to support nuclear weapons programs using tritium: component development, component evaluation operations, tritium recovery, and material analysis. To meet DOE's vision of completing the environmental restoration of the site by 2005, the SW/R Complex will be demolished, and contamination beneath the building will be removed.

It is anticipated that innovative technologies will be applied to the following decontamination tasks:

- tritium-contaminated gloveboxes
- tritium characterization techniques
- productivity improvement technologies
- tritium specialties decontamination
- piping system removal and disposition
- mixed waste treatment and disposal
- tritiated water treatment
- contaminated water plume under SW building

- miscellaneous rad/non-rad traditional building materials disposition

The Mound LSDDP Integrating Contractor (IC) Team includes the following: Babcock & Wilcox of Ohio; Lawrence Livermore National Laboratory (LLNL); British Nuclear Fuels Limited (BNFL); Foster Wheeler; IT Corp; LANL; Westinghouse Savannah River; Princeton Plasma Physics Laboratory (PPPL); and FIU.

Status and Accomplishments:

Completed Demonstrations:

1. Portable Scintillation Counter (Tech ID 2311):

The Lumi-Scint portable scintillation counter is a portable, single-tube liquid scintillation counter that can be set to respond to the low-energy beta radiation emitted from tritium. It uses a single photomultiplier tube and manual sample chamber. The Lumi-Scint operates on an internal battery or 110 VAC. The unit can be obtained with a printer to produce hard copies of its electronically stored data.

2. Water Solidification (Tech ID 2312):

This technology uses a polymer-based absorbent, Waterworks SP-400, that can be used to solidify aqueous waste. It is similar to other polymer-based absorbents that offer benefits over traditional solidification agents such as cement or Aquaset, the baseline solidification agent for the Mound facility. Benefits include the following: a high liquid-to-absorbent ratio; no mechanical mixing required to promote the absorption process; little to no volume increase in the waste after addition of the absorbent; and very high retention in the form of the gel-like material.

3. Oil Solidification (Tech ID 2313):

This contaminated oil solidification technology, NOCHAR PetroBond®, is a high-quality polymer offered by NOCHAR®, Inc., of Indianapolis, Indiana, and is specifically designed as a petroleum-based liquid absorbent. The PetroBond® absorbs very quickly with little increase in volume. The PetroBond® can be used for free-liquid control in storage, transport, and disposal of low-level radioactive waste.

4. Tritium Cleanup Cart (Tech ID 2974):

The Tritium Cleanup Cart is a portable tritium processing system. Used as a stand-alone cart for scrubbing tritium effluent, it

The Tritium Clean-Up Cart was demonstrated as part of the Mound LSDDP

provides a scrubbing process based on catalytic oxidation of tritium. Tritiated water is collected on removable molecular sieve dryers, which can be shipped as low-level waste below the 1080 curie "Type A" limit. The unit provides a projected decontamination factor of greater than 1000, with a process flow rate of 45 liters per minute. Design features include the following: mole sieve dryer beds configured in series with moisture monitors to prevent moisture breakthrough; process flow controllers in the main plumbing loop and air inlet system; process thermocouples, which provide process stream and enclosure over-temperature control; and an enclosure that can function as a ventilated hood during normal operating conditions, but also can be isolated when tritium concentrations inside the enclosure exceed the pre-selected control setpoint.

5. Pipe Cutting and Crimping System (Tech ID 2955):

The Pipe Cutting and Crimping System is a small hand-held, battery-operated crimping tool manufactured by Burndy Products. This tool utilizes a separate hydraulic pump with a high-pressure hose connecting the pump to the crimping head. U-shaped dies are contained in the head for crimping. A battery-powered hydraulic pump or an electric-powered pump can be used to develop 10,000 pounds per square inch (psi) of pressure to the crimping head. Thirty crimping operations can be performed before recharging is needed. The small dimension and light weight make this tool very suitable for crimping in tight quarters.

6. TechXtract® Chemical Decontamination of Metals (Tech ID 1450):

TechXtract® is a contamination extraction technology that utilizes chemical formula-

tions to remove contaminants from matrix surfaces and subsurfaces. Different chemical formulations are used for removal of specific contaminants from metal surfaces and subsurfaces. In this demonstration, the technology successfully decontaminated volumetrically contaminated stainless steel equipment. The demonstration showed greatly improved decontamination efficiency compared to the baseline method of decontamination using hydrogen peroxide.

7. Heavy Metals Removal from Mixed Waste Oils Using Self Assembled Monolayers on Mesoporous Supports (SAMMS) (Tech ID 1447):

The SAMMS technology was developed by the PNNL for removal and stabilization of Resource Conservation and Recovery Act (RCRA) listed metals (i.e., lead, mercury, cadmium, silver, etc.) and for removal of mercury from organic solvents. The SAMMS material is based on self-assembly of functionalized monolayers on mesoporous oxide surfaces. The unique mesoporous oxide supports provide a high surface area, thereby enhancing the metal-loading capacity. SAMMS material has high flexibility in that it binds with different forms of mercury, including metallic, inorganic, organic, charged, and neutral compounds. It removes mercury both from organic wastes such as pump oils and from aqueous wastes.

8. Barter Process (Tech ID 3062):

The Equipment Reuse, Bartered Sale of Used Contaminated Equipment to a Commercial Company (Barter Process) demonstration was recently completed. As a closure site, much of the DOE Miamisburg Environmental Management Project's (MEMP) equipment is planned for disposal. The Mound LSDDP team, instead of considering disposal as a first option, has demonstrated that there are benefits to the reuse of equipment at another facility or company over disposal. They recently completed a process to transfer used, tritium-contaminated equipment to a commercial company by means of a bartered sale agreement. The commercial facility was a Texas based Nuclear Regulatory Commission (NRC) licensed pharmaceutical company. The Mound LSDDP team effectively applied the process knowledge and methodology developed by the DOE National Center of Excellence for Metals Recycle (NMR) in Oak Ridge to facilitate equipment reuse at many DOE sites. NMR checklists stepped through the entire process and aided in evaluating potential equipment reuse prospects. The Mound Bartered Sale agreement was negotiated, and the first shipment of used equipment has been completed. Additional shipments will follow. As a result, DOE expects to avoid over $400,000 in equipment disposal costs and an additional $1 million by shortening the schedule for site closure. Based on the experience gained from accomplishing this project, the Mound LSDDP team is documenting the process so that other DOE sites can benefit from such equipment recycle and reuse agreements.

9. Electret-Passive Environmental Radiation Monitor (E-PERM) (Tech ID 2315):

The E-PERM® is a commercially available instrument designed to provide faster and less expensive means of determining the tritium contamination in air and on solid surfaces. For measurement of airborne tritium, the E-PERM® uses a chamber made of carbon filled polypropylene and a window made of thick carbon coated Tyvek® material, which is highly transparent to water vapor. For tritium surface monitoring, the E-PERM® system is used in a windowless mode. A mesh, supplied by the manufacturer, is used over the surface of a contaminated object before deploying the electret ion chamber to prevent contamination of the chamber.

10. Waste Isolation Composite (WIC) (Tech ID 3061):

WIC is an ultra-high-strength composite material with high durability and low permeability that can be used for isolation or encapsulation of high-activity tritiated liquids. This is especially useful for disposal of liquid waste with high curie content tritiated water. Structural integrity tests were completed and the composite's performance was satisfactory. In the third quarter of 2001, radiological leach tests were conducted.

11. Fiber Optic Tritium Detector and Quantifier (Tech ID 2956):

This technology, developed by McDermott Technologies, Inc., uses a fiber optic bundle coupled to a photomultiplier tube detector to measure low energy beta radiation from

radioactive decay of tritium. It allows the fiber bundle to be introduced directly in the liquid (oil or water) sample for tritium detection and quantification. This technology demonstration was completed in the third quarter of 2001.

12. Liquid Scintillation Vial Shredder and Disposal Process (Tech ID 3066):

This technology developed as a follow-up to the successful demonstration and wide deployment of oil solidification (Tech ID 2313). The process has proved very successful for disposal of liquid scintillation counting (LSC) vials used for laboratory analysis. The technology uses a mechanical shredder to crush the vials containing scintillation cocktail. It captures the shredded vials in a net and the scintillation cocktail is captured in a drum for treatment with NOCHAR N991. During the demonstration, five 55-gallon drums containing about 73,650 vials of LSC waste were processed. Following the successful demonstration, the shredder and disposal processes were deployed at Mound on June 19, 2001.

Current Reporting Period Activiti

Completed Demonstrations

1. TechXtract® Chemical Decontamination of Concrete (Tech ID 1450):

In the current period, demonstration of the TechXtract® chemical treatment to remove surface (and potentially near-surface) contamination from concrete was completed in a tritium laboratory at LLNL. Data was collected to measure the tritium-rebound effect and to measure performance of the technology for removing below surface contamination. An additional application of the TechXtract® process was needed to eliminate the sources of rebounding contamination. Primarily this turned out to be migration from untreated floor areas adjacent to the test patch. The earlier crack source hypothesis appears less important. Success followed two thorough treatments of the entire lab floor space.

2. Concrete Characterization Process:

The Tritium Concrete Characterization Process allows profiling of contamination in depth in floors, walls, and ceilings. The process uses a hollow core hammer drill that is coupled through a rotating seal to a vacuum line and sampling train. All of the particulates generated from the drilling operation are removed by the high-flow vacuum system and is captured in a high efficiency particulate air (HEPA) filter cartridge. The particulates are then transferred to a sample vial and a field measurement of the contamination level is carried out in a portable liquid scintillation counter.

Completed Deployments

A major milestone in the disposal of Mound's tritiated waste oil was achieved on September 28. Around 100 liters of tritiated waste oil (0.59 curies/liter) were solidified using the Nochar PetroBond® absorbent polymer (N990) and placed in five 22-gallon containers approved by the U.S. Department of Transportation and Nevada Test Site. The Nochar N990 polymer solidified the tritiated waste oil flawlessly with a 1 to 1 weight ratio of oil to polymer. It meets all the regulatory requirements for disposal at the Nevada Test Site.

For more information:

http://www.doe-md.gov/lsdd/lsdd.htm

Tech ID 2201

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▼Idaho National Engineering and Environmental Laboratory (INEEL) Fuel Storage Canals and Associated Facilities D&D LSDDP

Objective and Scope: The INEEL Fuel Storage Canals and Associated Facilities LSDDP is led by an IC Team consisting of Parsons Engineering, BNFL, BBWI, TLG Engineering, FIU, and Idaho State University. This LSDDP will utilize funding, technologies, and expertise from the Offices of Environmental Restoration, Science and Technology, and Nuclear Material and Facil-

The Idaho National Engineering and Environmental Laboratory (INEEL)

ity Stabilization, and from industry, universities, and the international community.

The project includes the following areas:

- Test Reactor Area 660 (TRA-660), housing two underwater research reactors, the Advanced Reactor Measurement Facility, and the Coupled Fast Reactivity Measurement Facility, with a 30,000-gallon interconnecting water canal that was sometimes used for fuel storage. These facilities were utilized for reactivity insertion experiments that were later scaled up for experiment design in larger reactors. The two reactors achieved criticality in 1960 and 1962, respectively. Neither has operated since February 1991. Contamination includes radioactive elements, lead, and chromium.
- TRA Filter Pit system, consisting of five structures containing large filters associated with test reactor operations. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos. The filters are located in restricted entry pits, and D&D work will have to be done remotely and in confined spaces.
- Test Area North 620 (TAN-620) Initial Engine Test Control Room a massive underground, shielded, heavily reinforced concrete structure that served as the control center for the engine tests in the Aircraft Nuclear Propulsion Program. These tests were conducted at the INEEL in the late 1950s and 1960s. Contamination includes asbestos, mercury, lead, and potential radiation.

This LSDDP is a high priority for the DOE/Commercial Nuclear Utilities D&D Consortium, with demonstrated technologies having deployment opportunities in the nuclear utility market through the consortium. Resulting deployments throughout the DOE complex alone could generate a potential cost savings and mortgage reduction of $20 million.

Seventeen innovative and improved technologies were demonstrated in the following areas: underwater inspection, characterization, and dismantlement; inspection, characterization, and dismantlement in restricted spaces; recycle of materials from D&D activities; removal of loose radiological contamination on walls, floors, piping, and equipment; removal of fixed radiological contamination on concrete; tank, vessel, and piping decontamination; lead plate radiological decontamination; and high-radiation exposure fields.

Status and Accomplishments: The 3D-Gamma Locator Device (GLD), the Isotopic Identification Device (IID), and the Ultra Lift device were all demonstrated and deployed during the period from July 10 to August 2, 2001. The final report for the LSDDP has been drafted and the demonstrations for the LSDDP are considered complete.

The INEEL LSDDP reviewed over 300 technologies, screened 141, and demonstrated 17. These 17 demonstrated technologies have been deployed a total of 69 times at facilities other than those where the technology was demonstrated, and 10 have become baseline at the INEEL. Sixteen needs have been removed from the Needs Management System and another 16 have been modified as a direct result of using these new technologies.

The 10-year projected cost savings at the INEEL resulting from use of the technologies demonstrated in this INEEL LSDDP exceeds $39 million dollars.

Current Reporting Period Activities: The demonstrations of the 3D-GLD Technology, the IID, and the Ultra Lift device at TAN-616 were originally postponed due to delays in the Russian Ministry in establishing a release date for the shipment. The demonstrations were rescheduled for July 2001, and the success of the demonstrations at the TAN-616 facility resulted in the technologies being immediately deployed at Cubicle 13 of the Power Burst Facility.

For more information:

http://id.inel.gov/lsddp/

Tech ID 2202

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LANL Tritium Technology Deployment LSDDP

Objective and Scope: The objective of the LANL Tritium Technology Deployment LSDDP is the reduction of cost, risk, and schedule for the deactivation; decontamination, and decommissioning of DOE's tritium facilities through the deployment of previously demonstrated cost-effective innovative technologies. The goal of this LSDDP is to identify and select at least 20 technologies that can be deployed at multiple sites. At LANL, leveragable funding of $6.6 million is available over two years of the project. Leveragable funding from other sites is expected as well.

The primary deployment site for this LSDDP will be the LANL Tritium Systems Test Assembly (TSTA), an existing facility that is being stabilized by the current DOE program operator, the Office of Fusion Energy Science (OFES), in anticipation of transfer to the Office of Environmental Management (EM) for decontamination and decommissioning. The main experimental building is a 3700 square-foot high bay that contains process equipment and gloveboxes for fusion tritium R&D.

Status, Accomplishments, and Current Reporting Period Activities: The LANL Tritium Facilities LSDDP management team conducted the project kick-off meeting at LANL August 9–10, 2001. The kick-off meeting concluded with a tour of the TSTA facilities at LANL. During the meeting, the organizational structure for the project was finalized.

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Canyon Disposition Initiative

Objective and Scope: The Hanford Canyon Disposition Initiative (CDI) Project is a collaborative project that initially included participation across EM. Participating EM offices included the Offices of Waste Management Environmental Restoration, Science and Technology, and Nuclear Material and Facility Stabilization. This partnership was driven by the understanding that decisions made on the disposition of the canyons would impact all of these programs. Due to the reorganization of EM in September 1999, CDI is being overseen by the Office of Project Completion.

The CDI Project is evaluating the feasibility of using the five chemical processing facilities (canyons) as assets for disposal of low-level wastes, instead of a mortgage liability. The 221-U Facility is being used as a pilot for this evaluation. The DOE Richland Operations Office (RL) Environmental Restoration Program signed an Agreement in Principle with the regulators at the beginning of FY1997, to conduct the evaluation for the disposition alternatives for the canyon facilities. In 1996, a Canyon Task Team of personnel from RL, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology (known as the Tri-Parties) conducted a series of workshops to identify an approach for the long-term disposition of the five main processing facilities in the 200 Area (B, T, and U facilities, the Plutonium Uranium Extraction Facility and the Reduction Oxidation Plant) at the Hanford Site. The assessment made by the Canyon Task Team centered on the possibilities of removing the processing facilities, leaving all or part of the facilities in place and identifying alternative beneficial uses for the facilities. The team concluded that the technical approach for dispositioning any of the facilities could be bounded by the following seven alternatives:

Alternative 0:
No Action

Alternative 1:
Full Removal and Disposal

Alternative 2:
Decontaminate and Leave in Place

Alternative 3:
Entombment with Internal Waste Disposal

Alternative 4:
Entombment with Internal/External Waste Disposal

Alternative 5:
Close in-Place - Standing Structure

Alternative 6:
Close in-Place - Collapsed Structure

The Record of Decision for the 221-U Facility will generate regulatory and technical precedence for future disposition of the other four remaining processing facilities at Hanford and other such facilities across the DOE complex.

Status and Accomplishments: Approximately $200,000 in funding from FY2000 has carried over into FY2001 for a Phase III feasibility study and proposed plan for a record of decision. CDI was also awarded $700,000 additional funding through Pollution Prevention (P2).

Current Reporting Period Activities: The Phase III Feasibility Study and the Proposed Plan are being developed to support the Record of Decision.

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http://bhi-erc.com/canyon/canyon.htm

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Mound Facilities Long-Term Stewardship (LTS) Initiative

Objective and Scope: The Mound LTS Initiative is designed to identify, select, demonstrate, and deploy technologies and systems that will provide DOE, regulators, stakeholders, and the public with the assurance that the public and the environment are protected from harm after cleanup of the Mound site is completed in FY2006. This initiative is intended to serve as the prototype for LTS of all DOE buildings and equipment. It will serve as a test bed for a suite of real-time integrated surveillance and monitoring systems, which will function autonomously to transmit data to remote locations.

Mound Facilities

Status, Accomplishments, and Current Reporting Period Activities: In early September, the Mound Facilities LTS Initiative Kick-Off Meeting was conducted at the Mound Plant Site, Miamisburg, Ohio. The project Technology Team was identified and progress was made in developing a path forward. It was decided that LTS technologies would be selected to support/enforce institutional and administrative controls. Follow-up events such as biweekly conference calls, all-hands meetings every 3 to 4 months, and a workshop for technology vendors either the first week of December or sometime in January were tentatively scheduled.

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Highly Selective Nuclide Removal System Accelerated Site Technology Deployment (ASTD)

Objective and Scope: In 1992, the last of the five DOE production reactors at Savannah River Site (SRS) was placed into shutdown mode, with no intention to restart. With this action, the site entered an extensive deactivation and long-term surveillance and maintenance life-cycle phase of these facilities.

The integrity of the aging facilities has become a concern in recent years. Large volumes of contaminated water exist at some of these facilities at SRS (for example, fuel storage and disassembly basins). Treatment of this water requires removal of the water from the basin and shipment to the F and H Area Effluent Treatment Facility (ETF). A cost-effective and safe technology is needed to process the basin waters on location and selectively remove radioactive materials without transporting the water to ETF. The technology must reduce targeted nuclides to near DOE release limits and condition the water for direct release. Efforts to address these concerns have been initiated under the current funding for reactor monitoring and are being incorporated into the overall facility deactivation, decontamination, and decommissioning planning strategy. With the uncertainty of the basin integrity over time, a technology that can remove radioactive contamination from the basin water while minimizing secondary waste generation is essential to the success of the deactivation of the DOE reactor basins. The SRS ASTD is deploying an innovative, highly effective water treatment system to remove selected radionuclides (both strontium and cesium) from millions of gallons of water. Overall, D&D life-cycle costs are expected to significantly decrease via deployment of the technology.

Status, Accomplishments, and Current Reporting Period Activities: The SRS R-Area Reactor Basin water is being treated with a 3M/Empore® Cartridges membrane (for Cs-137) and the Graver/Selion System (for Sr-90). The first 3M/Empore® Cartridges Ion-Exchange technology demonstration was initiated at R-Area Basin on June 21, 2000 and completed on August 16, 2000. As of July 25, 2001, over six million gallons of R-Area Basin water have been treated with the Cs-137 3M/Empore® removal system. The demonstration showed 97% removal of Cs-137, with Cs-137 activity in the basin reduced to within the target cleanup level. 3M/Empore® Cartridges have proven to be very successful throughout the DOE Complex and treatment with the 3M/Empore® Cs-137 removal system at SRS R-Area Reactor Basin will continue in FY2002 in parallel with the Graver/Selion Sr-90 removal system.

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Integrated Excavation Control System (IECS) ASTD

Objective and Scope: This ASTD involves a partnership between Fernald Environmental Management Project (FEMP) and INEEL to procure and deploy an excavator arm with real-time sensors for precision excavation of above-Waste Acceptance Criteria (WAC) materials and real-time pre-certification surveys in complex terrain. The IECS will address real needs at Fernald and other sites that require the complex excavation of radionuclide-contaminated soils during the below-grade D&D of large structures.

Status, Accomplishments, and Current Reporting Period Activities: After the completion of acceptance testing, it was determined that minor hardware and software modifications were needed. Plans have been developed to prioritize and complete the modifications that were identified during the acceptance testing. Work on these items is underway. These modifications are scheduled for completion by early December 2001. Project personnel are confident that the Excavation Monitoring System (EMS) will be fully operational in the spring of 2002 for the start of the full-scale excavation in Area 3A.

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Remote Size Reduction for Large Hot Cell Deactivation ASTD

Objective and Scope: The 324 Building, located at the Hanford Site near Richland, Washington, is being deactivated to meet state and federal cleanup commitments. The 324 Building has several highly radioactive tanks, tank vaults, piping, and large hot cells containing complex chemical processing equipment. To meet the cleanup commitments, there is a need to deploy more rapid and remote size–reduction, debris collection and removal, characterization, and decontamination methods. Readily deployable deactivation methods that reduce worker exposure, secondary waste generation, costs, and risks are also needed. Deployment of a remote/robot work platform in the 324 Pipe Trench with full reach capabilities will significantly accelerate work tasks, will eliminate the need for multiple, specialized tool design and procurement, and will reduce the overall program risks.

The Hanford Site ASTD project will fund the deployment of a robot work platform to support deactivation of the 324 Pipe Trench. Through this project, Hanford will procure and deploy a remote/robot work platform that is positioned with an overhead crane to perform a variety of deactivation activities. Following the Pipe Trench cleanup, the work platform will be deployable for other 324 and Hanford site cleanup missions.

Status and Accomplishments: The original contract with Cybernetix was modified to include fabrication of a special support structure to allow the robotic work platform to be placed in the 324 Building's Airlock Pipe Trench. All contracted equipment was received in March 2001. The robotic system was then set-up in Hanford's 306-E Building to perform Site Acceptance Testing, receive initial training from the vendor, perform detailed training with facility operations and maintenance staff, and perform a broad suite of deactivation tasks in mock-up of the Pipe Trench. In the Pipe Trench, the robotic system will be cutting and handling over 1,000 feet of piping, removing drip pans, condensers, and high-activity debris. Deployment of the robotic system began in late September 2001.

Current Reporting Period Activities: On September 26, 2001, the robotic system was transferred from the 306-E Building to begin its deployment in the 324 Building's Airlock Pipe Trench. This initial deployment is scheduled to last through late November 2001. Due to its robust design, the robotic system is targeted for use on a variety of deactivation tasks in the 324 Building over the next 4–5 years.

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LANL Decontamination and Volume Reduction System (DVRS) ASTD

Objective and Scope:: LANL currently has more than 2,400 cubic meters of oversized metallic TRU waste in storage. This waste is non-certifiable for shipment to the Waste Isolation Pilot Plant (WIPP) in its present packaging configuration. In addition, another 3,000 cubic meters of similar waste from on-site D&D activities and site upgrades are at various locations at LANL. To meet cleanup commitments,

there is a need to deploy a system for decontaminating and volume-reducing this waste that is less costly, less labor intensive, and quicker than the baseline method of processing the waste entirely by hand. The disposal of oversized metallic TRU waste is a problem at many DOE sites.

The DVRS process will reduce the volume of oversized metallic TRU waste using an integrated system of technology and equipment for assaying, confinement, decontamination, and volume reduction. The project includes a 13,200-square-foot outer building along with a 2,500-square-foot contamination-control structure nested inside. Both structures have active ventilation and contamination control; a multi-station passive-active, neutron non-destructive analysis system; several fixed and portable processes for decontamination of metal objects; and a large dedicated system to shear and crush large metallic objects for placement in 55-gallon drums.

Status and Accomplishments: Both the outer building and contamination control structure are complete.

Current Reporting Period Activities: No significant activity to report.

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Tech ID 2242

http://
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Oversize TRU Waste Laser Cutting System ASTD

Objective and Scope: DOE-Nevada has a need to size-reduce and characterize 58 oversized TRU-contaminated metal boxes with a total volume of 270 cubic meters prior to shipping them to the WIPP. The contents of these boxes are 32 contaminated gloveboxes, a metal cutting lathe, lengths of metal piping, lengths of angle iron, and various scrap metals. The Hanford material requiring size reduction includes a minimum of 150 gloveboxes, as well as ductwork and piping. At Rocky Flats Environmental Technology Site (RFETS), the laser cutting system will also be applied to 150 contaminated gloveboxes.

Status, Accomplishments, and Current Reporting Period Activities: GSI-Lumonics recently was purchased by Laserdyne Prima, which is now conducting the laser cutting system integration testing. Laserdyne expects to receive the final safety equipment by mid-September. The final vendor acceptance test for the total laser cutting system integration is scheduling for late September. At this time, Fluor Hanford has not been able to identify a location or funding for the pre-operational testing of the laser system at Hanford following the Laserdyne acceptance test. Therefore, the project team has decided to perform pre-operational testing at the LANL, probably at Q-Site. Department of Defense (DoD) laser cutting tests were performed recently at the Q-Site, which makes the Q-Site an appropriate site for the pre-operational testing. The current plan is to ship the laser system from Laserdyne to LANL in October, after the vendor acceptance test is performed.

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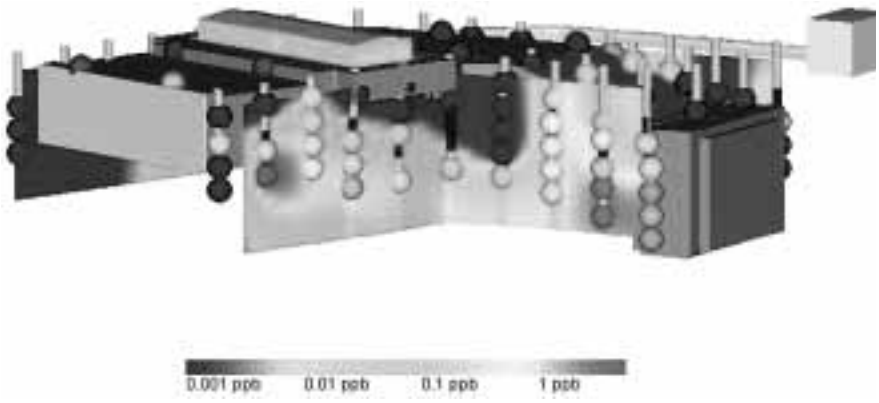
Smart 3D Characterization of the Brookhaven Graphite Research Reactor (BGRR) ASTD

Objective and Scope: The BGRR was a graphite-moderated and -reflected, air-cooled, thermal neutron research reactor that operated from 1950 to 1968. In 1997, following safe shutdown during the 1970s and 1980s, a site-wide review found radioactive water in the BGRR underground air-cooling ducts. Subsequently, it was determined that a comprehensive investigation of the environmental

vulnerabilities and overall facility condition should be conducted. The first phase of this investigation involves characterization to support D&D planning of the BGRR Facility including: the reactor building (701), reactor pile (702), fan house (704), instrument house (708) and canal house and outdoor pad (709). Characterization will also be needed to support waste disposal operations during decommissioning operations and to verify regulatory compliance following D&D operations.

The DDFA supports the BGRR Decommissioning Project characterization effort through an ASTD project funded in September 2000. The Smart 3D Characterization ASTD project will deploy innovative characterization and sampling techniques coupled with 3D modeling capabilities to characterize soils and below-grade concrete ducts. These below grade ducts (BGD) are connected the reactor pile and have filters and fans to enable cooling air to be drawn through and exhausted. The ducts consist of two separate plenums measuring 10 ft x 14 ft x 170 ft each. The ducts are known to have collected rainwater following shutdown of the BGRR and are considered a potential source of subsurface soil contamination. If thorough subsurface characterization shows that the soil surrounding the ducts is not contaminated, it may be possible to leave all or portions of the BGD in place rather than removing them. This will result in significant savings in remediation of the Brookhaven site.

Status, Accomplishments, and Current Reporting Period Activities: Surface (0-18 inches) and subsurface soil sampling is continuing using the Small Footprint Geoprobe, two additional conventional Geoprobes, and hand augering. Areas that were clearly identified as potential leak pathways through the completion of the ASTD Tracer Gas Study are the focus of the initial subsurface characterization. Surface soils and samples of the asphalt ground covering are taken for analysis in 6-inch lifts. Subsurface soil samples are taken by Geoprobe, using 1.5-inch diameter cores in 4-foot lifts until groundwater elevation or refusal is reached. These 4-foot core samples are then carefully divided in half to provide characterization samples every 2 feet. Collection of more than 1,300 samples are anticipated. In Situ Object Counting System (ISOCS) (Tech ID 2098), BetaScint (Tech ID 70), and Alpha Spectroscopy (if indicated by gross alpha-beta analyses) are being used while sample collection activities continue.



A 3-D visualization of the Environmental Visualization system, depicting the Below-Grade Ducts with simulated PFT leak data. Medium gray areas include higher concentrations of tracer gas (i.e., more leakage) and dark gray areas denote lower concentrations.

Four hundred thirty-four ISOCS samples were analyzed in August and 518 ISOCS samples have been analyzed to date. Sixteen were found to exceed current surface soil cleanup levels for Cs-137 of 23 pCi/g. Actual cleanup standards for subsurface soils are currently being negotiated with regulators based on estimated risk and land use scenarios.

A new BetaScint fiber optic detector arrived at Brookhaven National Laboratory (BNL). The system includes several improvements over the original design, including a built-in power supply, additional fiber optic sensors for improved sensitivity, and an on-board control module for simplified user-instrument interface. Shakedown, calibration, and repeatability testing was conducted on the new unit. The temporary BetaScint unit provided by the manufacturer will be returned on completion of this testing phase. Sr-90 analysis of soil samples from the below grade duct continued. BetaScint analysis requires a minimum sample size of approximately 2 kilograms, so not every sample is analyzed for Sr-90. Sixty-eight BetaScint samples have been analyzed to date, none of which contains Sr-90 in activity concentrations above 15 pCi/g, the current cleanup level for surface soils.

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RFETS D&D Initiative and Associated ASTD Projects

Objective and Scop RFETS is on an aggressive, accelerated schedule to achieve cleanup and closure by the end of 2006. The baseline plan for the Rocky Flats Closure Project involves dispositioning over 900 contaminated gloveboxes, more than 450 production process tanks, thousands of feet of ventilation system piping, and miles of production process piping. In order to accomplish this challenging goal, RFETS has incorporated into their baseline plan application of new and innovative technologies for characterization, decontamination, size reduction, and waste handling and packaging.

A significant cost in the D&D of buildings at RFETS is the size reduction and packaging of plutonium-contaminated gloveboxes, tanks, and other equipment. DDFA is supporting the disposition of these systems through the Rocky Flats D&D Initiative (RFI), as well as ASTD projects including:

- Enhanced In Situ Decontamination and Size Reduction
- Remote Operated Size Reduction System (ROSRS) (Tech ID 2916) (ROSRS is being transferred to Savannah River Site)
- Remote In Situ Size Reduction of Plutonium Gloveboxes (Tech ID 2987)
- Decontamination of Gloveboxes and Equipment without Size Reduction (Tech ID 2986)
- Upgrade Radiation Instruments

All of these projects seek to identify and deploy proven, commercially available technologies and innovative systems that require only minimal modifications for the safe and cost-effective disposition of contaminated processing equipment and systems. The RFI serves to augment the ASTDs and to support problem-specific deployments not currently funded by an ASTD project, such as the characterization and eventual removal of concrete-embedded equipment in Building 776.

Status, Accomplishments, and Current Reporting Period Activities:

1. Enhanced In Situ Decontamination and Size Reduction:

RFETS has initiated deployment of the Standard Waste Box (SWB) Counter, developed at LANL, for assaying TRU standard waste boxes. WIPP certification of the SWB is pending review of the initial data packages. The WIPP audit of the system has been completed. RFETS is responding to all the pertinent issues generated by the audit. The final response is anticipated to be completed by the end of the quarter. The first shipments of the SWBs are expected to begin in the first quarter FY2002. RFETS is actively pursuing the certification of the technology for drum waste.

2. Remote Operated Size Reduction System (ROSRS):

Due primarily to the success of the Inner Tent Chambers, a decision has been made not to deploy ROSRS at RFETS. Rocky Flats site management has decided not to install the ROSRS. Savannah River Site (SRS) has agreed to deploy the ROSRS technology in Building 105-C, which houses the existing SRS Decontamination Facility. Kaiser-Hill is scheduled to transfer the contract with Oceaneering Systems to Westinghouse Savannah River.

3. Remote In Situ Size Reduction of Plutonium Gloveboxes:

An In Situ Size Reduction System will be used to size-reduce and package oversized gloveboxes and other contaminated equipment in Building 771 that cannot be transferred to a centralized size reduction facility.

Award of the contract for an in-situ size reduction system to size reduce and package glovebox Lines 6&7 and Line 12 in Building 771 has been made to RedZone Robotics. The system includes:

- A mobile lift platform holding a manipulator for cutting and a boom for lifting and lowering material to the floor.
- A smaller mobile platform with a manipulator for material handling and waste box loading.
- A set of mechanical and plasma tools for size reduction.
- A control and video system.

All final issues have been resolved on the design package for the system and the subcontractor given approval to procure all components for system fabrication. Training of Site engineers and trainers on the system at RedZone Robotics in Pittsburgh is complete. Setup in a training area in Rocky Flats for shakedown testing and operator training shall occur in the first quarter of FY2002.

4. Decontamination of Gloveboxes and Equipment without Size Reduction:

This project supports the deployment of a suite of decontamination technologies to allow shipment and disposal of plutonium-contaminated gloveboxes, tanks, and other equipment while obviating size reduction requirements. By reducing surface contamination, this equipment can be disposed of as low-level waste (LLW), thus minimizing the total waste volume of material to be shipped to WIPP.

This task supports Site projects for the deployment of improved decontamination, instrumentation, and fixative technologies to allow shipping and disposal of plutonium-contaminated gloveboxes and equipment as low-level waste without the need for size reduction.

Four efforts are being supported by this Technical Task Plan (TTP) to improve the Site's ability to ship equipment as Surface Contaminated Objects (SCO).

- Building 371 has a current project to remove the raschig rings from eight tanks followed by decontamination of the tanks to SCO by steam injection of cerium nitrate. Removal of the raschig rings from the tanks was delayed due to startup of the plutonium metal and oxide processing system (PuSPS) near the tanks. Removal of these rings is currently underway although at a slower rate than desired. The fog and fix technology did not significantly reduce airborne contamination. Vacuum extraction of the rings is being investigated to speed the process of raschig ring removal. Decontamination of the first eight tanks is scheduled for the first quarter FY2002.
- A three-step aqueous decontamination process has been successfully deployed in Buildings 776 and 771. The technology is being used extensively in the D&D of both these buildings.
- 771 Project is evaluating vendor proposals for sludge removal and decontamination of tanks in the low-level waste processing building 774. Cleaning of the tanks will be complete by the end of the second quarter FY2002.
- Testing of the Pipe Explorer system for use in Building 771 is complete. The system had difficulty deploying in the room ventilation and exhaust ducts with building heating, ventilation, and air conditioning (HVAC) control in operation. Also, the membrane ruptured and depressurized during one test. As a better application of this technology, survey of potentially contaminated underground piping is being pursued with the Environmental Restoration organization.

5. Upgrade Radiation Instruments:

This project supports the deployment of a suite of state-of-the-art instrumentation and data collection systems required for compliance with radiation control, release limits, and control/tracking of waste.

Work on systems for D&D waste packaging, tracking, and electronic generation of WIPP and Nevada Test Site (NTS) certification documentation will be complete in the first quarter FY2002. Work to develop and deploy new criteria, methods, and instrumentation to increase SCO shipments is complete. Fabrication of a survey instrument capable of measuring low levels of plutonium under paint on walls and equipment is nearly complete with delivery expected in October. Remote survey of the inside of the Building 771 stack was completed to allow future demolition of the stack. The survey system was raised and lowered within the stack and both the instrument position and readings were transmitted to the data collection point on the ground, eliminating the need to core and sample the stack. Instruments are being investigated to quickly survey pipe less than 3 inches in diameter and will be deployed in the first quarter FY2002.

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Tech ID 2918

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Diamond Wire Saw Demolition and Size Reduction of a Reactor Bioshield ASTD

Objective and Scope: The Columbus Environmental Management Project (CEMP) was awarded an ASTD project to deploy a diamond wire saw system to size-reduce an activated bioshield and associated structures in a decommissioned research reactor at Battelle's West Jefferson site in Columbus, Ohio. The bioshield is made of high-density concrete approximately eight feet thick with an extensive internal lattice of carbon steel reinforcement bars. This technology was used successfully in decommissioning projects at Fort St. Vrain and Shoreham Nuclear Power Plants, but has seen little application within DOE's decommissioning projects. The estimated cost to size-reduce the Building JN-3 bioshield at West Jefferson is $780,000 using the diamond wire saw, compared to an estimated $1,051,000 cost to dismantle the bioshield with the baseline technology of heavy jackhammers. Thus, size reduction using the diamond wire saw represents cost savings of about 25 percent compared to the baseline approach. Subsequent deployments of the diamond wire saw are planned for Mound and West Valley.

Status, Accomplishments, and Current Reporting Period Activities: The use of the diamond wire saw has enabled Battelle Columbus Laboratories Decommissioning Project (BCLDP) to remove the JN-3 bioshield a year earlier than scheduled, at a $221K overall cost savings. The deployment also resulted in a demonstration of radiological and secondary waste controls required with this technology. During deployment, BCLDP developed improved water control, a water recycle system, and on-site wire rebuild capabilities.

The final Cost and Performance Report has been completed.

A diamond wire saw system is used to size-reduce an activated bioshield and associated structures in a decommissioned research reactor at Battelle's West Jefferson site.

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Reducing, Reusing, and Recycling Concrete and Segmenting Plate Steel and Tanks Utilizing a Universal Demolition Processor (UDP) ASTD

Objective and Scope: As D&D work at Fernald progresses from above-grade facilities to at-grade and below-grade facilities, there will be a need for new technologies to process concrete. Fernald can realize significant cost savings by reprocessing and reusing a portion of the site's concrete. There is a need for aggregate to build and strengthen the site's transportation infrastructure in and around the On-Site Disposal Facility (OSDF). Project personnel in the Soils and Water Division have an estimated need for up to 15,000 cubic yards of aggregate per year for the next 6 years. By not recycling the site's concrete, tons of aggregate will have to be imported from off-site locations and subsequently disposed in the OSDF. Reprocessing a portion of the concrete saves the costs associated with the purchase of virgin aggregate and its subsequent disposal cost. The site can also realize increases in safety, efficiency, and schedule by utilizing the plate shear capability of the UDP. Fernald has numerous large, heavy steel tanks including two water towers and numerous tanks made of stainless steel.

Through this ASTD, innovative technologies will be deployed to accelerate demolition/recycling of construction materials for road construction and for segmenting large, hard to cut, plate steel and tanks. The overall decommissioning life-cycle costs are expected to significantly decrease via the deployment of these technologies.

Status, Accomplishments, and Current Reporting Period Activities: The UDP has completed processing

13 concrete pads or structures containing approximately 2000 cubic yards of concrete. Numerous large roll-off boxes have been filled with the rebar that fell out of the concrete during crushing activities. The rebar is taken to the OSDF for disposal.

The concrete pads or structures completed are 10B, 10D, 10E, 12B, 12C, 12D, 12B-D adjacent area, 20B, 20C, 20H, East and West Reactivator Pad, and a portion of 19D. Field work will continue through October. Other locations targeted for concrete processing include 10A-Precipitator Pad (north and south), 10C Pad, Clearwell, and 12A Pad. These additional four structures contain over 2,200 cubic yards of concrete, bringing the project total to over 4000 cubic yards.

Reusing several hundred cubic yards of aggregate is planed for use as road base. The road will provide access to a storage area for roll off boxes used at the OSDF. Strengthening and rerouting of another road is also planned in the 3A Area of Fernald.

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Improved Measurement and Monitoring Systems (IMMS) ASTD

Objective and Scope: The FEMP is a 1,050-acre DOE Closure Site currently undergoing decommissioning and environmental restoration. As environmental cleanup work at the FEMP accelerates towards closure and LTS, there is an increasing need for new, innovative technologies to perform real-time physiological monitoring, land surveying, and wireless radon monitoring. In the process of D&D of DOE facilities, individual laborers sometimes need to work in or near radiolgical and hazardous locations, as well as in situations that lead to extreme physical conditions. These types of extreme conditions will likely occur in the upcoming FEMP Silos Project and in other restoration projects across the site. Technologies are needed that reduce workers' risk during engineering, construction, and environmental restoration operations. To minimize these risks, three new technologies have been identified for deployment at FEMP. Collectively, these technologies will provide for the monitoring of worker vital signs, improved land surveying, and the remote transmission of radon monitoring data.

Status, Accomplishments, and Current Reporting Period Activities:

1. Prismless Total Surveying Station:
The FEMP has been deploying Leica's Prismless Robotic Total Station on a full time basis. Daily and weekly projects supported by the Optical Total Station include construction activities, soil sampling and characterization projects, groundwater/aquifer restoration, Waste Pit volume calculations, and monthly monitoring of bank erosion along Paddy's Run.

The instrument continues to demonstrate high productivity regarding data collection and increased worker safety. Site survey technician is working with instrument and generating data sheet that will help in determining total cost saving.

2. Wireless Physiological Monitoring System:
A purchase order was issued to Siemens/Framatome to supply and install the physiological monitoring system and to train FEMP personnel on the use of the system. The system is to be delivered by December 31, 2001.

3. Wireless Integrated Radon Monitoring System:
The efforts are proceeding with the Wireless Integrated Radon Monitoring System. The vendor, Campbell Scientific, Inc., recently expanded the number of monitoring units from 10 to 20 at Fernald. Fernald is also going to add an additional 18 units at site expense.

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Intrusive and Non-Intrusive Characterization through Concrete Walls and Floors ASTD

Objective and Scope: In mid-FY2000, the MEMP was awarded an ASTD project to ascertain the nature and extent of contamination in an area under SW Building known as the "Old Cave." The Old Cave is actually the entombed remains of a 1950's hot cell, which must be removed before the City of Miamisburg, Ohio, will accept ownership of the Mound Site. In SW Building, the Old Cave is located under an area designated SW-19. Because of lack of knowledge of what is in the Old Cave area, ultra-conservative estimates of the amounts of actinium-227 and radium-226 have been made that required the Old Cave to be classified as a Category 2 Nuclear Facility. It is considered highly unlikely that that much radioactive material resides in the Old Cave. The approach is to characterize SW-19, the surroundings, and the entombment. In Phase I—Non-Invasive Investigations—the entombment will be characterized using ground-penetrating radar and time-domain electromagnetic gamma spectrometry, drain exploration, and radon monitoring. In Phase II—Invasive Investigations—they plan to perform these investigations with respect to the entombment via diamond core drilling and/or geoprobe with a real-time position location determination device. Once radioactivity levels are determined and a final design decision to the Baseline Plan is made, several enhancements that shorten the schedule and reduce costs may result. A baseline recovery of only one week would recoup the entire ASTD investment. If the baseline acceleration is greater than the one week, the return on investment will increase proportionally as additional weeks/months are saved from the baseline. Based on the Value Engineering Study, it is conservatively estimated that four months can easily be recovered when compared to the present technical approach.

Status, Accomplishments, and Current Reporting Period Activities:

The Old Cave project team and the Innovative Treatment and Remediation Demonstration (ITRD) team have completed their review of the SW/R Building Hazards Investigation document and the final draft is now complete. The document will be published at Sandia National Laboratories and will be released through the ITRD program at Sandia. Technology investigation and selection are commencing. The Old Cave project team has reviewed and commented on the final draft Project Plan for the Old Cave project. The draft plan describes the planned scope for the Old Cave excavation project and provides the process details. The plan also describes the hazards and engineering controls. A Statement of Work and supporting drawings have also been prepared for the waste box loading station and the Statement of Work and the Sole Source Justification materials have been prepared for the purchase of the BROKK robotic demolition and excavation equipment.

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Tech ID 2982

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MARSSIM Innovative Characterization at NTS

Objective and Scope: The NTS deployment of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) methodology and in situ characterization technologies will concentrate on non-standard applications present opportunities for significant cost savings when compared to the NTS baseline methodologies. These applications

include radiological characterization of various structures and waste packages associated with deactivation and decommissioning. This ASTD project consists of two components. The first component is the deployment of the ISOCS (Tech ID 2098) manufactured by Canberra Industries, Inc. This innovative technology will be used to assist in the radiological characterization of various structures and waste packages associated with the NTS D&D program. The second component is to use the MARSSIM methodology to verify that the exterior of the Area 25 Reactor Maintenance Assembly and Disassembly (R-MAD) facility can be released for disposal prior to demolition of the R-MAD structure. The purpose of this deployment is to compare the costs of conducting the MARSSIM release survey to the baseline methodology of a Radiological Control Technician (RCT) performing clearance surveys for each waste package.

Status, Accomplishments, and Current Reporting Period Activities: During July and August, the MARSSIM final release survey data was compiled, validated, and tabulated. In addition to the MARSSIM survey data correlation effort, Bechtel Nevada (BN) staff continued the deployment of the ISOCS for free release of materials removed from the R-MAD Building and the adjacent R-MAD Decontamination Building. The purpose of this activity was to further refine geometric work packages and collect ISOCS quality assurance/quality control (QA/QC) data.

The second Brookhaven National Laboratory (BNL)-staffed NTS deployment was scheduled for the third week of September. This deployment was canceled in the wake of the terrorist activities of September 11, 2001. The activities scheduled for this deployment include: ISOCS waste calibration of 55-gallon drums, waste calibration of B-25 boxes, review of NTS-developed ISOCS geometric models, and in situ measurements of contaminated ductwork. These activities have tentatively been rescheduled for the week of October 29.

Preliminary MARSSIM and ISOCS cost evaluation analyses have been completed and preparation of the draft Summary Report is underway. A draft Summary Report is on schedule for DDFA review in mid-November 2001.

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Demonstration and Deployment of Remotely Operated Size Reduction System ASTD

(formerly Contaminated Large Equipment)

Objective and Scope: SRS has identified over 600,000 cubic feet of radiologically contaminated large equipment (CLE) requiring disposition. This represents a much larger quantity than anticipated. DOE Order 435.1 will elevate regulatory attention and surveillance impacts for this stored material. The cost will increase significantly for deferring permanent disposition. Disposal of this material in its current condition would consume the SRS waste disposal capacity, be cost prohibitive, and waste DOE assets.

SRS originally proposed to procure a suite of four systems to augment existing infrastructure and facilitate size reduction and decontamination of CLE. The proposal was submitted and approved as an ASTD, titled Disposition of Contaminated Large Equipment. The original funding amount was $500,000.

The ROSRS was originally intended for deployment at RFETS, also as an ASTD. An alternate system was subsequently deployed. The ROSRS was combined with the SRS CLE project to form a new SRS ASTD, titled Demonstration and Deployment of ROSRS. The Scope of Work (SOW) was subsequently completely changed and rewritten. The scope now includes the installation, shakedown, and demonstration of the ROSRS at SRS in FY2002.

The approach proposed above capitalizes on the remotely operated technologies and equipment to minimize health and environmental risks, as well as to accelerate cleanup and reduce costs while meeting project objectives. The ROSRS will be used in conjunction with the SRS Decontamination Facility to provide capabilities for disposition of large

equipment and to support ongoing routine decontamination work.

Status, Accomplishments, and Current Reporting Period Activities: The revised TTP was approved on September 28, 2001. The contract transferal from Kaiser Hill LLC at RFETS to Westinghouse Savannah River Company at SRS is currently underway. Completion of this process is expected in October 2001 with the signing of the Request for Project Authorization at SRS.

The ROSRS itself is at the PaR Systems Facility in Shoreview, MN, awaiting shipment to SRS. Shipment is expected during the first quarter of FY2002.

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Deployment of Improved Technologies for Cleanout of the F-Reactor Fuel Storage Basin ASTD

Objective and Scope: Cleanout of the F-Reactor Fuel Storage Basin (FSB) is a key step in completing the Paths to Closure for the Hanford Site. The F-Reactor FSB has complex technical issues and unique challenges, including the identification, removal, and disposal of miscellaneous contaminated debris, which is potentially interspersed with pieces of spent fuel elements buried under 6.1 meters (20 feet) of sandy soil. The technical needs associated with the project include characterization, backfill removal and segregation, and material removal and segregation.

Historical data and preliminary characterization information indicate that the top 5.2 meters (17 feet) of fill should be free of radiological or chemical contamination and that most of the debris is expected to be found primarily in the lower 15 percent of the basin.

Status and Accomplishments:

Characterization of the F-Reactor Fuel Storage Basin:

The Advanced Characterization System (ACS) was deployed to characterize the F-Reactor FSB. The ACS deployment includes the GammaCam (Tech ID 1840) and ISOCS (Tech ID 2098) technologies. The Laser Assisted Ranging and Data System (LARADS) (Tech ID 1946) has also been deployed for characterization of the FSB.

The GammaCam, deployed in February 2001, provides a pseudo-color image of gamma-ray radiation fields superimposed on a visual image of the target. The GammaCam provides a means to remotely locate high-intensity gamma radiation sources buried in the F-Reactor FSB. Accurate dose assessments performed from a distance are advantageous from an as-low-as-reasonably-achievable (ALARA) perspective.

The ISOCS, deployed in February 2001, is a portable in situ Germanium-based spectrometry system that is designed to provide information on types and amounts of radioactive material. It will allow "fingerprinting" to identify irradiated fuel pieces in the F-Reactor FSB prior to excavation. This capability is valuable in addressing ALARA concerns, and in supporting project planning for packing, transporting, and processing materials as they are excavated.

The LARADS, deployed in March 2001, is based on an integration of a modified auto-tracking civil surveyors total station with a radiological detection system and storage of the information obtained from each into electronic files. These files can be used with Geographic Information System software to produce survey records or reports. These reports can be both graphical (with color-coded radiological levels overlaid on an AutoCAD drawing or a digital photograph of the survey area) or textual (with all radiological readings stored within a database along with x, y, and z positional coordinates). The LARADS was used to map the bottom of the F-Reactor FSB. The data are being used to determine "hot spots" where potential spent fuel fragments may be located.

Remote Operations in the F-Reactor Fuel Storage Basin:

The Remote Retrieval System was deployed in June 2001 to conduct remote operations in the F-Reactor FSB. The Remote Retrieval System consists of a Brokk 330N remotely operated vehicle with appropriate attachments

for excavation, dismantlement, and retrieval of soils and debris from the FSB.

The Compact Remote Console (CRC) (Tech ID 2180) was deployed in June 2001 in the F-Reactor FSB in conjunction with the Remote Retrieval System. The function of the CRC is to provide viewing and task control for remote operations. The built-in adjustable control chair is an integral part of the CRC and is a major feature of the human-factors-based focus on design. Four video panels are provided, the three lower panels are primary remote viewing, with the fourth panel typically used as a screen splitter to present an array of available camera views that are available to the operator. The viewing distance and height of the video array are adjustable. The CRC accommodates a remotely controlled device's controller on a swing-away arm that mounts to the left side of the chair.

Current Reporting Period Activities: Cleanout of the basin is ongoing. The characterization and remote retrieval tools are continuing to be deployed. Technology Deployment Benefit Analysis Fact Sheets have been completed for the GammaCam, ISOCS, and LARADS.

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Tech ID 3083

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▼D&D Consortium

Objective and Scope: In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the reach of benefits of the leading-edge technologies being deployed within the DOE nuclear complex. The MOU Consortium established a charter in early 1998 and identified challenging technological areas common to both DOE and the commercial industry. Both DOE and commercial sites will be used for these demonstrations and deployments.

DOE and EPRI are collaborating to conduct quarterly workshops at various nuclear plants around the country, each focusing on a particular decommissioning area. DOE and the utilities present the most recent, innovative technologies to improve productivity and worker safety while reducing cost. The workshops will solicit feedback from hands-on plant managers and field workers. Topics covered to date address low-level waste disposal, concrete decontamination, embedded pipe decontamination, and site characterization.

Status and Accomplishments: The first technology demonstration resulting from the DOE/EPRI/Utility Consortium was completed at the Rancho Seco Nuclear Power Plant.

The first technology demonstration involved the concrete shaving technology developed by Marcrist Industries, Ltd. Two separate pieces of equipment were demonstrated. Both used a diamond-impregnated shaving drum as the cutting tool for removal of the concrete surface. Dust generated was collected by a vacuum system and deposited in a waste drum. The first piece of equipment was a self-propelled, electric powered floor shaver. The second piece was a hydraulically powered wall-shaving unit.

Current Reporting Period Activities: The DDFA has coordinated with the Rancho Seco staff and Florida International University (FIU) to start another round of demonstrations of innovative technologies. The DDFA assisted FIU and Rancho Seco Site personnel in selecting 2 technologies for demonstration, as well as choosing specific areas of the Rancho Seco site where the tests could be performed. Logistical details are being resolved and the Draft Test Plan for the demonstration of the On-Line Decontamination was developed, and initial comments resolved. Current plans are for the demonstrations to be scheduled for the next quarter.

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Florida International University

Objective and Scope: The FIU-HCET is working on several D&D related research projects under a grant awarded by the DOE Office of Science and Technology (OST). These FY2001 projects include:

- D&D Technology Assessment Program
- Technology Information Management and Dissemination
- Technology Development, Integration, and Deployment Program
- Worker Health and Safety Research and Technology Development
- D&D Waste Disposition and Treatment
- Long-term Monitoring and Stewardship for DDFA

Status, Accomplishments, and Current Reporting Period Activities:

Technology Assessment Program: Under this project and earlier technology assessment projects funded from other sources, FIU-HCET has assessed over 80 baseline and innovative technologies for D&D application under standardized, non-nuclear testing conditions.

Five hand-held cutting tools, including a reciprocating saw, the Porter cable saw, the Evolution 180 circular saw, the Adamant saw, and a carbide-tipped circular saw, were demonstrated on mock-up fiberglass-reinforced plywood glovebox crates August 13–17, 2001. A representative from IT Corporation assisted in oversight of the demonstration, and LANL sent two technicians to perform the cutting operations. A technology summary report will be included in the October 2001 monthly progress report.

The TechXtract chemical decontamination process (Tech ID 1450) was demonstrated at the FIU Department of Chemistry on mercury-contaminated metal and porous surfaces August 15–17, 2001. The test samples included carbon steel, stainless steel, copper, and aluminum metals and tile and grout materials. A technology summary report will be included in the October 2001 monthly progress report.

Technology Information Management and Dissemination:

Milestone 1: Worker Health & Safety and Waste Management Databases can be accessed at *http://www.dandd.org.*

Milestone 2: The vendor databases were incorporated into Worker Health & Safety and Waste Management Databases. TIS-LSDDP databases are being reprogrammed to allow vendors to edit contact information. The website is completed and is accessible for vendor information and searchable at *http://www.dandd.org.*

Milestone 3: The Technology Needs Forum can be accessed at *http://www.dandd.org.*

Technology Development, Integration, and Deployment Program:

Milestone 1: Bench-Scale Testing Results for improved cutting technology for D&D. Provide results of testing conducted at HCET. Completed per the completion criteria detailed in the FY2001 project technical plan. A report of the tested technology (Evolution 180 circular saw) was developed to explain the issues associated with the use of the technology.

Worker Health and Safety Research and Technology Development:

Milestone 2: Experiments dealing with metal cutting by plasma torch and oxyacetylene torch. Milestone 2 was completed.

D&D Waste Disposition and Treatment:

Polychlorinated Biphenyl (PCB)-contaminated material has been obtained for the internal demonstration of the pilot plant.

Long-Term Monitoring and Stewardship for DDFA:

A report (Milestone C018-M1), titled Further Study of the Fixatives for Long-Term Stabilization was submitted to the DDFA, and data were input into the DDFA database.

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International Agreement with AEA Technology (AEAT)

Objective and Scope: Through an International Agreement, the DDFA has engaged AEAT to use their knowledge and expertise to address specific deactivation and decommissioning problems throughout the DOE weapons complex. In FY2001, AEAT is supporting four projects, which emphasize the transfer of proven innovative technologies from the United Kingdom and Europe to the DOE complex.

Status, Accomplishments, and Current Reporting Period Activities:

Accessing & Sampling the Retention Basin at the INEEL Test Reactor Area

It is estimated that one to three feet of sludge remain unevenly distributed across the base of the retention basin at the TRA facility at INEEL. In 1972, the retention basin, a below-grade concrete settling tank 128 feet long by 40 feet wide by15 feet deep, was found to be leaking. As the first step towards the eventual removal of the tank from the ground, AEAT will work with site engineers to establish the best methods of gaining entry to the basin for sampling, inspection, and retrieval of the sludge.

Following presentation of the optimal approach to INEEL on June 26, 2001, AEAT has begun the preparation of the final report. This report will describe the sampling and remediation options which were evaluated as well as the optimal path forward approach recommended for sampling and remediation of the retention basin. The report includes cost and schedule estimates for the next phases of work.

Deployment of an ARTISAN™ Manipulator for Debris Retrieval from a Hot Cell Facility at the CEMP

AEAT has provided Battelle Columbus a hydraulic manipulator mounted on a mobile platform for size reduction, decontamination, and removal of debris from the West Jefferson Hot Cells. The ARTISAN™ manipulator replaces the existing master slave manipulators, which were not designed to perform the required tasks. The ARTISAN™ has been deployed throughout Europe to perform tasks similar to those required at West Jefferson.

Since delivering the system on June 19, AEAT has provided customer support to ensure satisfactory deployment of the ARTISAN™ system at CEMP's facilities. AEAT responded to the site's request for accessories and additional operating data. AEAT is now awaiting confirmation from CEMP on the readiness of the ARTISAN™ to be deployed into their hot cells.

Removal of Waste from the WD Complex at Mound

Building WD is a multi-story facility used for the treatment of low specific activity (LSA) radioactive wastes generated by process activities at Mound. The contaminated facility is 28,800 square feet and has exterior walls composed of reinforced concrete and concrete block. The roof is concrete slab. As the first step in the D&D of the facility, 33 waste tanks and other miscellaneous vessels must be emptied and removed. AEAT will assist Mound in determining the optimal approach for gaining entry into the tanks to allow sampling, inspection, and retrieval.

A small tank mixing system, currently in use at Oak Ridge National Laboratory (ORNL), will be transferred to Mound for deployment on two tanks at the WD Complex. AEAT has purchased and received the necessary components for the mixing system. Additionally, AEAT has completed fabrication of a mini-skid and enclosure system at their facility in Pittsburgh. These components were delivered and installed at Mound in August. Also in August verification testing of the jet pump pair was completed. On August 9, 2001, AEAT was notified that there would be delays in the site support activities of installation of the tank-top enclosure and its venting and the provisions for venting for AEAT's equipment. Once installation is completed, the pre-operational testing of the system should be completed in about one to two weeks. The operations will then take an additional six weeks.

Deployment of a Hydraulic Manipulator for Hot Cell Decommissioning in Building 324 at Hanford

AEAT will provide a robust, teleoperated ARTISAN™ Manipulator System that has a greater reach and higher payload capacity at full extension than the baseline mechanical master

slave manipulators currently in use at Hanford's 324 Hot Cell facility. The ARTISAN™ will be assembled to the specifications provided by the 324 Facility personnel, and will be capable of being deployed through the 324 Hot Cells' standard 10-inch (25.4 centimeters) manipulator ports, with the option of configuration to a mobile platform, if required. This hydraulic manipulator system will provide the ability to handle waste materials, deploy size reduction tooling, assist with inspection and assessments of radiological hot cells, and provide the ability to deploy radiological decontamination tooling for the 324 Facility Hot Cells and tanks.

The manufacture of the hydraulic and control systems is 50 percent complete and the mechanical components of the arm were received from the United Kingdom. Review of the ARTISAN™ system for Underwriters Laboratory (UL) certification was performed on August 7, 2001. The UL inspector identified a few design changes to the system that are necessary for UL certification. Implementation of these changes has begun.

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Small Business Innovation Research (SBIR) Program

Objective and Scope: The SBIR Program was established in 1982 under the Small Business Innovation Development Act. The objectives of the Program are to stimulate technological innovation; to use small business to meet federal research and development (R&D) needs; to encourage the participation by disadvantaged and minority persons in technological innovation; and to increase private sector commercialization derived from federal R&D.

In December 2000, the SBIR Program was re-authorized until September 30, 2008. Congress concluded that the SBIR program was successful in providing small businesses with opportunities to compete for federal R&D awards and that the SBIR had effectively stimulated commercialization of the resulting technology, benefiting both private and public sectors.

SBIR programs fund R&D efforts of a high-risk nature that have high commercial potential. Under the Small Business Innovation Development Act, each agency with an extramural R&D budget in excess of $100 million must establish an SBIR Program.

The SBIR Program is a three-phase process. Phase I is based on proposals submitted in response to solicited research topics by participating agencies. The purpose of Phase I is to evaluate and demonstrate the scientific and technical merit and feasibility of an idea. Phase I proposals describe the projected results of the proposed research, the approach to be used and how it will prove the feasibility of its approach. Phase I research efforts are typically six months in duration and awards normally do not exceed $100,000.

Companies that successfully complete Phase I can compete for Phase II funding to expand on Phase I results and continue development of the technology. Phase II is the principal R&D effort, generally lasting 24 months. Awards typically do not exceed $750,000.

Status and Accomplishments: Five FY2000 Phase I proposals were selected for Phase II awards. The awards are as follows:

(1) ARM Automation, Inc., Modular Robotics for Delivering On-Site Contamination Sensors and Mapping System to Difficult-to-Access Locations

(2) AUTOMITIKA, Inc., PipeTaz: Automated Pipe Asbestos Insulation Removal System

(3) ADA Technologies, Inc., Portable Multicontaminant Detection Instrumentation for R&D

(4) Intelligent Optical Systems, Inc., Intelligent Unmanned Monitoring of Remediation Sites

(5) X-Ray Optical Systems, Inc., Compact Polycapillary Based Microbeam X-Ray Fluorescence Analysis System for Remote Monitoring of Metal Contamination

Current Reporting Period Activities: No significant activity to report.

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2.2 Facility Characterization

Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS)

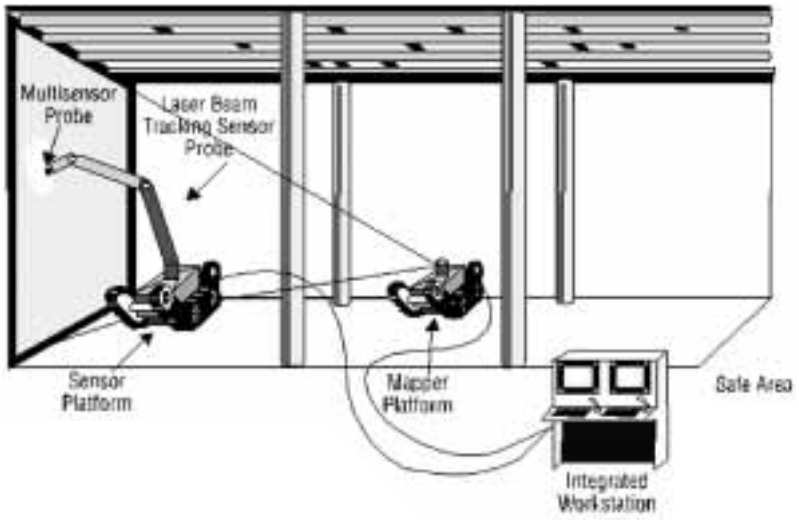
Objective and Scope: Coleman Research Corporation developed a remote system that can rapidly analyze in situ hazardous organic, radionuclide and heavy metal contaminants on structural materials. This remote system is the 3D-ICAS, which consists of a mobile sensor platform and a mobile mapper platform that operate in contaminated areas, and an integrated workstation that remains in a safe location. Development of this technology occurred in four phases.

Status, Accomplishments, and Current Reporting Period Activities: During Phase III, the 3D-ICAS was successfully integrated with mobile platforms at ORNL. The Coherent Laser Radar (CLR) Mapper was operated on the OmniMate robotic platform, and the contaminant analysis units and robot arm carrying the multisensor probe head were integrated on the overhead transporter. The system was subsequently demonstrated at ORNL's Robotics and Process Systems Division in October 1998. The demonstration was conducted in the hi-bay area using a wall unit specially constructed for the demonstration. The wall unit consisted of pieces of cement-based wallboard and a small piece of an asbestos-containing material (ACM). The wall unit was purposely contaminated with low levels of organic materials, alpha emitters, and a beta emitter. The demonstration consisted of mapping the wall unit, displaying the map, selecting points to be surveyed, and conducting the contaminant survey. The survey required moving the sensor/analysis unit with the transporter, acquiring the sensor unit with the 3D mapper, displaying the measured contamination in real time, and displaying detailed spatial and contamination data after the survey was completed.

A hardware failure the day before the demonstration prohibited acquisition of contaminant data from the high-speed gas chromatography/mass spectrometry (HSGC/MS). Only the Molecular Vibrational Spectrometer (MVS) provided real-time identification of the substrate material during the demonstration. This was a significant success since the MVS correctly identified the wallboard as being cement, even though the particular substrate sample had not been included in the system's neural network training set. Failure of the HSGC/MS was unfortunate, but its performance had been well documented and demonstrated prior to the demonstration at ORNL. The failure did not detract from the main objective of the demonstration, which was to show end-to-end system operation with the 3D-ICAS mounted on ORNL mobile platforms. The HSGC/MS was shipped back to Thermedics, parts were replaced, and the system was recalibrated.

During Phase IV, a field demonstration of the 3D-ICAS system was conducted at FIU in May 2001. The objective of this demonstration was to show the operation of the system mounted on the mobility platform. The platform conveys the coherent laser range mapper, sensing robot arm subsystem, contaminant analysis unit, and multi-sensor probe.

In this demonstration, the contractor was able to demonstrate the CLR mapping and the movement of the sensor probe to selected locations on the test wall. Two maps were successfully made of



Three-Dimensional Integrated Characterization and Archiving System (3D-ICAS) is a remote mapper and sensor platform to use in contaminated areas.

a 1-meter by 2-meter area and the CLR's micrometer-range accuracy was demonstrated. The robotic arm and sensor probe successfully surveyed a multiple-point set. The X-Ray Fluorescence (XRF) sensor for heavy metals detection was demonstrated but the GCMS sensor had failed. The HSGC/MS failure is believed to have resulted from field debugging, required after delivery of the wrong phase power supply to 3D-ICAS. The loss of time for repairs prevented the demonstration of the radionuclide detectors.

The final report has been completed.

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Tech ID 97

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▼Fast Response Isotopic Alpha Continuous Emissions Monitor

Objective and Scope: The objective of this effort was to develop and test Continuous Air and Emission Monitoring (CAEM) instrumentation for alpha-emitting radionuclides. This instrument was to be designed in order to certify the proper performance of airborne emissions from ambient air and in equipment emissions encountered during D&D of DOE's surplus facilities. The proposed system was to meet the DOE's alpha CAEM requirements through the development of an innovative, high-resolution, on-line air/gas alpha monitor. The instruments were to be capable of operating as a stack emissions monitor, as a process control instrument, or for the control of off-gas from decontamination, dismantlement, and air handling equipment.

Initial efforts were focused on the development and evaluation of a rapid alpha-counting-based instrument to monitor ambient air and emissions to meet the monitoring and equipment control needs of surplus facilities undergoing D&D. This development was to establish the feasibility of a prototype instrument for use in detecting radionuclides that were present or that would create susceptibility to exposure throughout the DOE complex. The prototype instrument was to be tested under the supervision of DOE's Inhalation Toxicology Research Institute in Albuquerque, New Mexico. Based on the prototype results, efforts were to be continued to full-scale commercial prototype for demonstration in one of DDFA's LSDDPs.

This project was a two-phase developmental effort. Phase I involved the design, development, and preliminary testing of a laboratory-scale instrument. Testing was initially to be conducted using naturally occurring radon progeny in ambient air. If the optional Phase II was exercised, the Phase I instrument would have been critically evaluated at the Lovelace Respiratory Research Institute (LRRI) with characterized plutonium aerosols. Then an improved instrument would have been built and field-tested at a suitable DOE site.

Status, Accomplishments, and Current Reporting Period Activities: The Thermo Power Corporation (Tecogen Division) developed a novel Continuous Air Monitor (CAM) instrument for monitoring alpha-emitting radionuclides, using a technology that can be applied to Continuous Emission Monitoring (CEM) of thermal treatment system off gas streams.

During February 2001, NETL was informed that Thermo Technologies, a subsidiary of Thermo Power, was being eliminated. The project was in the base phase of a two-phase developmental effort. This phase involved the design, development, and preliminary testing of a laboratory-scale instrument. At this point, Thermo Power had completed the development of a first prototype and an advanced prototype unit and had been scheduled to perform a field demonstration under an LSDDP during the summer of 2001.

Due to these developments, the alpha air monitor was transferred to the Environment, Safety, and Health (ESH) group at LANL, where they will use the instrument in everyday operation. No further development is planned. The alpha water monitor (Tech ID 312) was also transferred to the radioactive liquid waste treatment facility at LANL. The water monitor was developed with similar technology under a previous NETL contract with Thermo Power.

The final report for this project has been completed.

For more information:

Tech ID 2225

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Technology for Real-Time Measurement of Surface and Airborne Beryllium

Objective and Scope: The objective of this contract is to develop, test, and demonstrate an innovative real-time monitor for surface and airborne beryllium. This field-portable device is based on Laser-Induced Breakdown Spectroscopy (LIBS) and will be applicable to continuous air monitoring; field analysis of filters from personal air monitors, and analysis of surface wipe samples. Another potential application is a point and shoot device for direct measurement of beryllium on a surface. Accurate and timely detection, and monitoring of beryllium is critical to worker safety during deactivation and decommissioning activities. Beryllium dust is a significant workplace hazard. Exposure to beryllium particles can cause chronic beryllium disease (CBD)—an irreversible and sometimes fatal scarring of the lungs—in certain people. Beryllium metal has been produced for various industrial uses and has been widely used in aerospace and defense applications. The baseline method for beryllium analysis is sending samples to an off-site laboratory, which may require days or weeks to obtain results. RFETS, ORNL, Y-12, LANL, and the DoD have beryllium issues.

Status and Accomplishments: On September 30, 2000, a contract was awarded to Science Engineering and Associates (SEA) to develop a technology for Real-Time Measurement of Airborne and Surface Beryllium. The contractor has been working to establish lines of communication with RFETS, where demonstration of the instrument is planned. Following minor revisions to the Scope of Work, a subcontract was issued to LRRI. Under this subcontract LRRI will prepare various beryllium on filter samples for SEA, provide laboratory space at the LRRI facility for SEA to conduct LIBS measurements of beryllium filters, and provide consultation related to the design of the beryllium monitor. The SEA design staff held its first design meeting where the conceptual design for the prototype monitor was defined. Slight refinements to the conceptual instrument design were made to incorporate the input from the RFETS technical contacts.

Current Reporting Period Activities: In this quarter, SEA conducted LIBS tests on beryllium-contaminated filters provided by RFETS personnel. RFETS provided SEA with a set of filters that contained beryllium at the following concentrations (in micrograms): 0, 5.12, 10.2, 51.1, and 78. The purpose of these samples was to develop a LIBS calibration that would be used to perform quantitative analysis of unknown samples. SEA evaluated the samples, created a calibration model, and performed predictions for the unknown samples. There is a clear correlation between the beryllium mass and LIBS signal.

In conjunction with the evaluation of the RFETS samples, SEA further developed the methodology for calibration and analysis of data. SEA is utilizing principle component analysis (PCA) to evaluate the spectra. One of the advantages of this type of data analysis is in its ability to readily categorize the spectra and determine whether the spectra is consistent with the calibration model. For example, if the composition of the ambient dust varies widely from what is normally seen and the LIBS spectra is effected, then the PCA can detect that and mark the data accordingly. An approach that SEA is taking will attempt to categorize the data such that these and other types of potential errors are detected.

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2.3 Facility Decontamination

High Productivity Vacuum Blasting System

Objective and Scope: The objective of this project is to improve the productivity and economy of existing vacuum blasting technology, which is used to remove radioactive contamination, PCBs, and lead-based paint while providing worker protection through continuously recycling of the material and dust from the decontamination tasks. This project will focus on redesigning and improving existing vacuum blasting components, including blast head nozzles, ergonomic handling of the blast head by reducing its weight, brush-ring design, vacuum level regulator, efficiency of dust separator, and operational control sensors. The redesign is expected to enhance the productivity and economy of the vacuum blasting system by at least 50 percent of current vacuum blasting systems.

LTC Americas will develop the necessary mathematical models of air-particle flow in the nozzle, in the blast head and interface area, and in the dust separator to study the flow characteristics and interaction of the various elements of the system. The purpose of this model development is to increase the productivity and economy of existing vacuum blasting technology by 50 percent. Based on the results of this modeling effort, the contractor will test the system and verify that the above system components perform according to the mathematical simulations. The contractor will then complete the preliminary design of the components of the proposed system. This will include an overall configuration of the system, including material selection and testing, definition of the range of dimensional and weight parameters, and conceptual arrangement or design of the blast head unit a nd dust separator unit. Based on the preliminary design, the contractor will procure components and perform fabrication and assembly of the proposed system.

The performance of the system will be evaluated in the laboratory mock-ups representing various cleanup situations and environments. The contractor will review, analyze, and interpret data collected from the tests and develop a productivity enhancement profile of the pre-prototype unit including economic analysis. Based on the laboratory test results, the contractor will modify, change, and make adjustments to enhance the capability of the system.

Status and Accomplishments: LTC Teletrak, Inc. (LTC) improved a currently used decontamination technology, Vacuum Blasting, for large-scale cleanup of contaminated D&D concrete and steel surfaces. LTC's goal was to increase the technology's productivity by at least 50 percent by redesigning and improving existing vacuum components including blast nozzle, blasthead, wind curtain, dust separators and control sensors for both real-time characterization and lift-off shutdown control.

In Phase I, mathematical models and related code were developed to simulate the entire process numerically. Based on the modeling data, an innovative rectangular nozzle and a new centrifugal separator were designed, manufactured, and tested. The tests were performed to verify the mathematical models. The numerical results agreed with the measured data with a deviation within 10 percent. Experimental results also showed that if the new innovative design rectangular nozzles replace the old circular nozzle, a more than 50 percent increase in productivity efficiency can be achieved. The newly designed centrifugal separator offers a high-efficiency separation increase from about 30 to 75 percent, even using finer abrasives.

Phase II has been completed. During this phase, the pre-prototype design of the improved high efficiency vacuum blasting system was tested at FIU-HCET. The results demonstrated an improvement in productivity of 53 percent for concrete cleaning and 38 percent for steel plate over the original design.

Current Reporting Period Activities: In Phase III, LTC designed and constructed two prototypes, one with a standard size nozzle (¼-inch) and one with a large nozzle (⅜-inch). Field verification testing of the High Productivity Vacuum Blasting System was performed at FIU-HCET again on coated steel plate and concrete wall. Results showed the productivity of the standard blasthead to be increased by 63 percent and 83 percent over baseline technology for coated steel plate and concrete wall surfaces, respectively. The productivity rate of the large blasthead provided a further increase of 111 percent and 85 percent for the steel plate and concrete

surfaces over that of the newly designed standard blasthead (240 percent over standard baseline). The tasks of this project have been successfully completed and the goal of improving blasthead technology by more than 50 percent has been achieved.

The final report for this project has been completed.

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Technology Deployment for Asbestos Destruction

Objective and Scope: Asbestos Recycling Incorporated (ARI) was awarded a firm fixed-price contract to process 10,000 pounds of ACM from SRS. ARI's thermochemical treatment unit consists of modular components designed for hazardous waste treatment. The system will be used to remineralize asbestos resulting in non-toxic, non-regulated, asbestos-free aggregate suitable for recycling. The modular systems include a waste pretreatment system, a rotary hearth, an off-gas processing system, and a product-handling system. These systems are designed to accommodate a variety of waste types and contaminants.

Status and Accomplishments: The contract was awarded to ARI on September 30, 2000. On October 20, 2000, NETL held a project kick-off meeting that included a presentation from ARI describing the technology to be used, the scope, the schedule, and other pertinent aspects of the project. In early October 2000, ARI coordinated with DOE's Savannah River complex and DOE's asbestos abatement contractor to arrange for abated asbestos to be picked up by ARI's selected trucking contractor. ARI contracted with Freehold Cartage, Inc., Eutawville, South Carolina, to pick up the asbestos and transport the material to ARI's facility located in Tacoma, Washington. During this time, ARI also secured a permit from the Puget Sound Air Quality Agency that allows temporary storage of the asbestos pending the issuance of a final and permanent permit.

The asbestos was loaded onto the Freehold Cartage truck on October 18, 2000 and was transported without incident to Tacoma on October 23, 2000. The 441 bags of asbestos were unloaded into a steel shipping container, which was then properly labeled and locked. The asbestos will remain in storage until processed.

Current Reporting Period Activities: ARI has assembled the thermochemical conversion unit that will destroy the Savannah River Site asbestos waste at their Tacoma facility. The majority of the preparation activities for the demonstration have been completed. On June 25, 2001, ARI began shakedown testing of the thermochemical conversion unit. Due to permitting delays, the project has been extended by three months to the end of December 2001. This November, ARI is scheduled to begin processing the Savannah River Site asbestos waste at their Tacoma facility.

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2.4 Facility Dismantlement and Material Disposition

Robotics Crosscutting Programm

Objective and Scope: The Robotics Crosscutting Program (Rbx) supports the DDFA through design and integration of remote systems and capabilities used for near-term facility deactivation and ongoing surveillance and maintenance activities with extended application to final facility decommissioning. Deployment of remote D&D systems will reduce worker exposure to hazardous environments and provide productivity increases leading to substantial cost savings. Rbx also provides the technical interface for ongoing activities conducted by NETL Industry Programs and the University Research Program in Robotics (URPR) in the area of remote/robotic systems development.

Status and Accomplishments: During FY2001, Rbx is continuing the development of two remote systems: the Telerobotic Manipulation System (TMS) (Tech ID 2181) and Telerobotic Control (Tech ID 2939). The Telerobotic Manipulation System was established as a project within the Rbx D&D product line as a new start in FY1999. From Rbx interactions with the Tanks Focus Area, a similar near-term need was identified for a remote system to perform decontamination of pits associated with underground storage tanks at Hanford. Thus, the Rbx D&D activity was merged with the Rbx Tank Waste Retrieval (TWR) project for development of a prototype "Pit Viper" system. The Rbx D&D product line has assisted in the conceptual development of the Pit Viper system and have provided operator console and telerobotic controls technologies for use in the system. The long-term target for D&D deployment of this system is within plutonium processing canyons at Hanford or Savannah River.

Pit Viper Cybernetix manipulator system

The Telerobotic Control development activity addresses improved remote operation by providing advanced controls capabilities for remote manipulator systems. These advanced controls capabilities will increase effectiveness and efficiency of remote operation. This technology will be integrated with the Compact Remote Console (CRC) (Tech ID 2180) and deployed within the TMS.

Current Reporting Period Activities: Rbx staff participated in a Technology Safety Data Sheet (TSDS) review for the Pit Viper system. Members of the International Union of Operating Engineers (IUOE) observed the operation of the Pit Viper system while it performed spraying, cutting, and pick and place tasks. Pacific Northwest National Laboratory (PNNL) is currently assessing the tooling requirements for deployment of the Pit Viper in the C104 Heel Pit. Potential tasks include: size reducing and removing insulating foam that has separated from the underside of the pit cover plate, removal of the foam, removal of debris (accumulated dirt, sand, paint chips, etc.) from the floor of the pit, wall scraping, high-pressure water spraying, and possible removal of the drain plug.

INEEL Rbx staff assisted in the deployment of the Russian Gamma Locating Device (GLD) (Tech ID 2991) and an Isotopic Identification Device (IID) (Tech ID 3063) on July 31 at the INEEL Power Burst Facility Cubicle 13. This deployment followed the successful demonstration at Test Area North 616 the previous week. The deployment was completed without incident and provided the characterization information necessary to plan future D&D work in the Cubicle 13.

Initial testing of the TMS using the Schilling manipulator and a plasma torch was conducted. Testing included verification of the automated tool pick up and return capabilities and several cutting trials using the plasma torch. Straight line and square pattern cuts were made on flat plates; however, the technique is expandable to

PNNL Staff hosted tour of Pit Viper cold test facility for the Hanford Site Technology Coordinating Group Management Council.

curved surfaces (tanks/vessels, large pipes, etc.) as well as structural members such as I-beams with some additional work. Some further optimization of the torch settings is necessary, but essentially the capability goal for the fiscal year has been met. The testing and demonstrations performed this reporting period demonstrate the successful integration of the compact operator console, enhanced Schilling controller, the Schilling Titan II hydraulic manipulator, and telerobotic control into a full-scale TMS.

Rbx staff provided support to the University of Tennessee Knoxville (UTK) Mechanical and Aerospace Engineering and Engineering Science (MAES) department for integration of the Robotic Task Scene Analysis (RTSA) capability onto the TMS computer hardware. The intent is to have the TMS computers configured and loaded in order to test the RTSA functionality at UTK. The computers will be moved to ORNL where integration into the TMS will be started in FY2002. Interaction was also initiated with the UTK Electrical Engineering department's image processing group, which has a URPR grant tied to the DDFA.

Finally, due to the large number of requests from across the complex for acquisition of the CRC, Rbx staff has been working with a commercial vendor to produce the technology. This requires working through the Technology Transfer Office in order to get the designs licensed to the firm.

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2.5 Worker Safety and Other Projects

Protective Clothing Based on Permselective Membrane

Objective and Scope: Membrane Technology and Research (MTR), Inc., is developing and demonstrating improved protective clothing that provides protection equivalent to current garments, but is lighter weight to improve comfort and is breathable to allow water vapor to escape, therefore reducing heat stress. Improved protective clothing will be made of an innovative ultra-thin, permselective outer membrane. The membrane is extremely permeable to water vapor escaping from the wearer, but highly impermeable to hazardous compounds. Fabric properties will be optimized and prototype suits will be tested during Phase I. In Phase II, 20–30 suits will be fabricated and used in a variety of extensive, comparative trials in the laboratory and at a non-hazardous site.

Status and Accomplishments: Development of fabric materials and laboratory tests on the fabric has been completed. In laboratory tests, water vapor transmission rates of 600x900 g/m2/day have been measured through the fabric. This water vapor transmission rate is far superior to butyl rubber suits with a water vapor transmission rate of 0x10 g/m2/day. Chemical vapor transmission rates have been equal to or lower than rates for the fabrics of commercial suits.

Uretek laminated two rolls of the fabric. One roll of fabric (90 meters by 30 inches), MTR1, uses rip-stop nylon as both inner and outer layers, and the second roll (40 meters by 30 inches), MTR2, uses the rip-stop nylon on the outside and a flexible, lightweight, non-woven fabric on the inside.

An innovative fabric combines an ultrathin, permselective outer membrane with a sorptive inner layer.

The prototype suits manufactured by Kappler Systems received the following tests by outside laboratories: chemical permeation, physical properties, sweating mannequin, and heat stress modeling. In general, the results are not as good as expected; although the fabrics do combinewater permeability and reducedheat stress with chemical protection, neither the chemical permeation resistance nor the reduction in heat stress was as high as hoped. The economic analysis was updated based on this new data. The analysis shows that MTR1 provides the greatest benefits in productivity; however, the benefit does not appear to justify the higher cost of the suit made of this fabric. MTR2 fabric has less productivity benefit and a higher selling price, and so is less attractive than MTR1.

The Phase II permselective garment testing by the International Union of Operating Engineers (IUOE) was concluded in August 1999. The garments tested for personnel comfort and well-being were those assembled by MTR's potential commercialization partner from the permselective fabrics supplied by MTR, Tyvek, and non-breathable garments like Saranex. The garments were all full bodysuits with hoods (for comparison purposes), and contained a more spacious cut in the chest and waist/crotch area than other manufactured garments, and this was very noticeable and appreciated by the test personnel. This also helped the garments to be more durable. Examples of tasks performed include crawling through confined spaces, performing metal grinding, and loading and hauling material in a wheelbarrow. In general the MTR garments were as comfortable with respect to heat-stress as the Tyvek garments, and were much more comfortable than the non-breathable garments. The test personnel all had very good comments concerning the MTR garments. Communications have continued with a potential commercialization partner and an economic analysis has been performed.

Current Reporting Period Activities: The permselective membrane material development project concluded in September 2001. The draft final report indicates that the Membrane Technology and Research (MTR), Inc., developed permselective membrane fabrics provide liquid splash protection while allowing for perspiration release through the garment. During Phase II, the permselective fabric manufacturing steps were significantly simplified, resulting in a 30 percent reduction in manufacturing costs. Permselective membrane protective suits were prepared in collaboration with MTR's potential commercialization partner and heat stress testing with human test subjects was conducted by the International Union of Operating Engineers (IUOE). The IUOE tests confirmed that the MTR protective fabric is significantly more comfortable than non-breathable materials.

The life-cycle costs for the MTR permselective protective fabric compared very favorably with polyvinyl chloride and Saranex/Tyvek coveralls. These costs are dependent upon garment cost, reuse, decontamination, maintenance, storage, and disposal. Using the MTR suit twice before disposal results in a total-cost-per-productive-hour of $25.90, which is a very significant saving over the Phase I economic analysis and similar splash protective garments. Along with the detailed economic analysis that was performed, market opportunities were identified for the novel MTR protective fabric: (1) Liquid splash protective clothing for hazardous waste site operations; (2) liquid splash protective clothing for emergency response; and (3) Class 3 NFPA 1994-compliant protective clothing for civilian use during chemical terrorism incidents. At the present time, MTR's collaborative partner is not proceeding with commercialization of the MTR permselective protective fabric.

For more information:

Tech ID 95

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Modular Manipulator for Robotic Applications

Objective and Scope: This project focuses on the needs of Automated Plutonium Processing (APP) tasks that involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of APP gloveboxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates, which make this task virtually impossible to automate with existing technology.

In order for automation systems to be successful within DOE facilities, they must provide maximum functionality, flexibility, ease of use, and reliability, while facilitating the rapid deployment of each custom system. This work concentrates on in-depth design and deployment of self-contained actuator modules, which will be used to construct a robotic manipulator tailored for APP tasks. A human-scale manipulator will be built from two sizes of DISC Actuator and will replace existing human labor within plutonium gloveboxes. The modular nature of ARM Automation's technology readily enables installation and maintenance of automation within "hot" boxes.

Status and Accomplishments: ARM Automation has developed a modular actuator that is used as a building block for custom robotic-manipulator systems. These modular manipulator systems are well suited to the challenges associated with automation of glove box operations. For this project, modular actuators were configured into a robotic system capable of plutonium repackaging operations, a typical glovebox operation in Automated Plutonium Processing (APP).

Current Reporting Period Activities: This project concluded in July 2001. All of the manipulator components have been designed, fabricated, and tested. The technology was demonstrated at ARM Automation's facilities in a simulated glovebox environment. Two aspects of the modular system were successfully demonstrated. The first involved demonstrating the usefulness of the quick connects for passing the modules through the glove port of a glove box and then assembling the manipulator. The second task demonstrated the ability of the system to perform a typical procedure involved with the processing of pure Plutonium into a MOX fuel: inserting a convenience can filled with plutonium, into a hermetically sealed stainless steel primary can. All demonstration activities were videotaped. An Innovative Technology Summary Report (ITSR) for this project is under development and should be available in 2002.

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3.0 Programmatic Structure and Organization

The Office of Science and Technology (OST), as part of DOE's Office of Environmental Management (EM), manages a national program to conduct basic and applied research, and technology development/demonstration/deployment that is essential to completing a timely and cost-effective cleanup of the DOE nuclear weapons complex. OST provides environmental research results, as well as cleanup technologies and systems to meet EM program high priority science and technology needs while reducing technological risks and cost of implementation of effective solutions. The OST works closely with both the Office of Site Closure (EM-30) and the Office of Project Completion (EM-40) to accomplish its mission.

To achieve a comprehensive, integrated approach to developing and providing science and technology solutions, EM has separated the site cleanup needs into a set of five problem areas. A Focus Area has been established to plan and manage EM's research and development investments to develop solutions to each of these five problem areas:

- Deactivation & Decommissioning Focus Area
- Tanks Focus Area
- Nuclear Materials Focus Area
- TRU and Mixed Waste Focus Area
- Subsurface Contaminant Focus Area

In addition, three crosscutting technology areas were established where technology needs and targets are relevant to more than one Focus Area:

- Characterization, Monitoring and Sensor Technology (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

The Industry Program conducts competitively selected activities that involve the private sector in developing, demonstrating, and implementing improved technologies that address the needs of the focus areas and the crosscutting areas.

The result of this structure of programs is that the D&D Focus Area is positioned to support those research areas defined as highest priority by EM-50 and DOE customers.

The Role of NETL

The Federal Energy Technology Center, with physical sites in both Pittsburgh, Pennsylvania and Morgantown, West Virginia, was redesignated by Former U.S. Secretary of Energy Bill Richardson, as the National Energy Technology Laboratory (NETL). As the 15th national laboratory, NETL becomes part of the national laboratory research system. This is the largest research system of its kind in the world with more than 30,000 engineers and scientists conducting research and research and leading-edge experiments. As part of this system, the new National Energy Technology Laboratory will join Argonne National Laboratory (Illinois); Brookhaven National Laboratory (New York); Lawrence Berkeley National Laboratory (California); Fermi National Accelerator Laboratory (Illinois); Idaho National Engineering & Environmental Laboratory (Idaho); Lawrence Livermore National Laboratory (California); Los Alamos National Laboratory (New Mexico); National Renewable Energy Laboratory (Colorado); Oak Ridge National Laboratory (Tennessee); Pacific Northwest National Laboratory (Washington); and Sandia National Laboratories (New Mexico and California).

Rita A. Bajura, NETL Director, a career federal executive with more than 18 years experience in government-industry energy partnerships, continues in her leadership position as head of the single management team that serves both physical sites with a combined working force of more than 530 federal scientists, engineers, and administrative staff. NETL is responsible for nearly 600 research projects; most involving the development of advanced fossil fuel technologies.

In addition to the new national laboratory's core capabilities, Secretary Richardson announced that a newly created Center for Advanced Natural Gas Studies, would be an integral part of NETL's research endowment.

Senator Robert C. Byrd (D-WV) remarked in the course of the dedication that, "Much of the laboratory's work is dedicated to the worthy goal of developing innovative, clean and efficient technologies that will allow our nation to meet its growing energy needs.

As the nation's newest national laboratory, it will continue to help light a pathway for a new era of energy use that will ensure a comfortable standard of living for our children and our children's children."

NETL also manages a significant portion of the technology development needed to clean up sites in the government's nuclear weapons complex. In February 1995, the then Morgantown Energy Technology Center was selected by EM-50 to be the implementing organization for the D&D Focus Area. As such, it brought the experience gained from being the implementing organization for the Industry Program, which competitively selects industrial R&D performers through Research Opportunity Announcements (ROAs) and Program Research and Development Announcements (PRDAs). As the lead organization for D&D implementation, NETL is responsible for the planning, monitoring, and evaluating RDDT&E pro-jects to meet the requirements of EM-50 and its customers in EM-30.

Stakeholder Feedback

The stakeholders in the D&D Focus Area include DOE headquarters; DOE operations offices; DOE sites and their operating contractors; D&D technology developers and users in the private sector; federal, state, and local regulators; and the communities around affected DOE facilities. These stakeholders have been providing input to focus area planning and implementation; program contacts are provided on the first page of this report.

"It's time we elevate the profile and prestige of this world-class facility, which has been helping solve energy and environmental problems for more than 50 years,"

Bill Richardson, Former U.S. Secretary of Energy,
National Energy Technology Laboratory
Dedication Ceremony

4.0 BACKGROUND

The D&D Focus Area was established to develop and demonstrate improved technologies and systems that could solve customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents. The mission also includes facilitating the acceptance, approval, transfer, commercialization, deployment, and implementation of these technologies and systems.

These technologies are needed to address the pressing needs of deactivating more than 7000 contaminated buildings and decommissioning more than 700 buildings. In addition, material disposition is required for over 600,000 tons of metal and 23 million cubic meters of concrete in contaminated buildings and for 400,000 tons of metal currently in scrap piles. The major drivers for this focus area are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, sur-veillance, and maintenance using currently available baseline technologies.

D&D Focus Area Strategy

Subsequent to the selection of NETL as the lead organization for the D&D Focus Area, a program review of all FY95 projects was held in May 1995. Based on this and other recent program reviews, as well as the general requirement for fiscal constraint throughout, the following strategies were developed:

Programmatic Strategy

- Focus D&D technology development program on large-scale demonstrations emphasizing full-scale demonstrations using a suite of improved technologies.
- Demonstrate technologies only through large-scale demonstrations.
- Focus on technologies that are identified as high priority by customers, that have wide applicability, and that have a commitment to be considered for use by customers.
- Emphasize demonstration and deployment of private-sector technologies.
- Technical Strategy

In the near term, emphasize technologies to effectively support:

- deactivation of facilities,
- decontamination of surfaces,
- reuse of bulk contaminated materials,and
- application of remotely operated dismantlement systems

In the middle term, emphasize technologies to effectively support:

- applications of remote surveillance systems,
- characterization of volumetrically contaminated materials,
- decontamination of bulk materials, and
- adoption of release standards for bulk contaminated materials.

Large-Scale Demonstrations and Deployment Projects

A cornerstone of the D&D Focus Area is its series of large-scale demonstration and deployment projects. The LSDDPs demonstrate innovative and improved D&D technologies at full scale, side by side with existing commercial technologies. The intent is to compare benefits from using a suite of improved and innovative D&D technologies against those associated with baseline D&D technologies. This approach provides an opportunity to test improved and innovative D&D technologies at a scale that will provide meaningful cost and performance information to the potential end-users of the technology.

5.0 Upcoming Events

November 2001

Environmental Management Science Program FY2001 Awards Kick-Off Workshop

November 27–28, 2001
Knoxville, TN

February 2002

Waste Management 2002

February 25–28, 2002
Tuscon, AZ

May 2002

IEEE International Conference on Robotics Automation

May 11–15, 2002
Washington, DC

June 2002

ANS Annual Meeting — The Revival of the Nuclear Power Option

June 9–13, 2002
Hollywood, FL

August 2002

Spectrum 2002

August 4–8, 2002
Reno, NV

We list conferences and workshops of interest to our readership. Please let us know if you would like us to include your event on this page.

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6.0 Acronyms

3D	Three Dimensional
3DICAS	Three Dimensional Integrated Characterization and Archiving System
ACM	Asbestos Containing Material
ACS	Advanced Characterization System
AEAT	AEA Technology
ALARA	As Low As Reasonably Achievable
APP	Automated Plutonium Processing
ARI	Asbestos Recycling Incorporated
ASME	American Society of Mechanical Engineers
ASTD	Accelerated Site Technology Deployment
BGD	Below-Grade Duct
BGRR	Brookhaven Graphite Research Reactor
BN	Bechtel Nevada
BNFL	British Nuclear Fuels
BNL	Brookhaven National Laboratory
CAEM	Continuous Air and Emission Monitoring
CAM	Continuous Air Monitor
CBD	Chronic Beryllium Disease
CDI	Canyon Disposition Initiative
CEM	Continuous Emission Monitoring
CEMP	Columbus Environmental Management Project
CLE	Contaminated Large Equipment
CLR	Coherent Laser Radar
CMST	"Characterization, Monitoring and Sensor Technology"
CP-5	Chicago Pile 5
CRC	Compact Remote Console
CSI	Cambell Scientific Incorporated
DDFA	Deactivation and Decommissioning Focus Area
DoD	Department of Defense
DOE	Department of Energy
DVRS	Decontamination and Volume Reduction System
EM	Environmental Management
EMS	Excavation Monitoring System
E-PERM	Electret-Passive Environmental Radiation Monitor
EPRI	Electric Power Research Institute
ESH	"Environment, Safety, and Health"
ETF	Effluent Treatment Facility
EVS	Environmental Visualization System
FEMP	Fernald Environmental Management Project
FIU	Florida International University
FIU-HCET	Florida International University's Hemispheric Center for Environmental Technologies
FSB	Fuel Storage Basin
FY	Fiscal Year
GLD	Gamma Locator Device
HAMMER	Hazardous Materials Management and Emergency Response Training and Education Center
HCET	Hemispheric Center for Environmental Technologies
HEPA	High Efficiency Particulate Air
HFBR	High Flux Beam Reactor
HSGC/MS	High-Speed Gas Chromatography/Mass
HVAC	"Heating, Ventilation, and Air Conditioning"
IC	Integrated Contractor
IECS	Integrated Excavation Control System
IID	Isotopic Identification Device
IMMS	Improved Measurement and Monitoring System
INEEL	Idaho National Environmental and Engineering Laboratory
ISOCS	In Situ Object Counting System
ISSRS	In Situ Size Reduction System
ITRD	Innovative Treatment and Remediation Demonstration
ITSR	Innovative Technology Summary Report
IUOE	International Union of Operating Engineers
LANL	Los Alamos National Laboratory
LARADS	Laser Assisted Ranging and Data System

LIBS ..... Laser-Induced Breakdown Spectroscopy
LLNL ..... Lawrence Livermore National Laboratory
LRAD ..... Long Range Alpha Detector
LRRI ..... Lovelace Respiratory Research Institute
LSA ..... low specific activity
LSC ..... Liquid Scintillation Counting
LSDDP ..... Large Scale Demonstration and Deployment Project
LTC ..... "LTC Teletrak, Inc."
LTS ..... Long Term Stewardship
MAES ..... Mechanical and Aerospace Engineering and Engineering Science
MARSSIM ..... Multi-Agency Radiation Survey and Site Investigation Manual
MEMP ..... Miamisburg Environmental Management Project
MOU ..... Memorandum of Understanding
MTR ..... Membrane Technology and Research
MVS ..... Molecular Vibrational Spectrometer
NETL ..... National Energy Technology Laboratory
NMR ..... National Center of Excellence for Metals Recycling
NRC ..... Nuclear Regulatory Commission
NTS ..... Nevada Test Site
ORNL ..... Oak Ridge National Laboratory
OSDF ..... On-Site Disposal Facility
OST ..... Office of Science and Technology
PCA ..... Principle Component analysis
PCB ..... Polychlorinated Biphenyl's
PFT ..... Perfluorocarbon Tracer
PNNL ..... Pacific Northwest National Laboratory
PPPL ..... Princeton Plasma Physics Laboratory
PuSPS ..... Plutonium Metal and Oxide Processing System
QA/QC ..... quality assurance/quality control
R&D ..... Research and Development
Rbx ..... Robotics Crosscutting Program
RCRA ..... Resource Conservation and Recovery Act
RCT ..... Radiation Control Technician
RFETS ..... Rocky Flats Environmental Technology Site
RFI ..... Rocky Flats D&D Initiative
RL ..... Richland
R-MAD ..... Reactor Maintenance Assembly and Disassembly
ROSRS ..... Remote Operated Size Reduction System
RTSA ..... Robotic Task Scene Analysis
SAMMS ..... Self Assembled Monolayers on Mesoporous Supports
SBIR ..... Small Business Innovation Research
SCO ..... Surface Contaminated Objects
SEA ..... Science Engineering and Associates
SOW ..... Statement of Work
SRS ..... Savannah River Site
SWB ..... Standard Waste Box
TAN ..... Test Area North
TMS ..... Telerobotic Manipulation System
TRA ..... Test Reactor Area
TRU ..... Transuranic
TSDS ..... Technology Safety Data Sheet
TTP ..... Technical Task Plan
TWR ..... Tank Waste Retrieval
UDP ..... Universal/Demolition Processor
UL ..... Underwriters Laboratory
URPR ..... University Research Program in Robotics
UTK ..... University of Tennessee Knoxville
VACIS ..... Vehicle and Cargo Inspection System
WAC ..... Waste Acceptance Criteria
WBS ..... Work Breakdown Structure
WIC ..... Waste Isolation Composite
WIPP ..... Waste Isolation Pilot Plant
XRF ..... X-Ray Fluorescence